THE MADRAS JOURNAL OF LITERATURE AND SCIENCE.

EDITED BY THE COMMITTEE

OF THE

Madras Literary Society

AND

AUXILIARY ROYAL ASIATIC SOCIETY.

Vol. XVIII

MADRAS:
PRINTED BY PHAROAH AND CO.
ATHENÆUM PRESS—MOUNT ROAD.
1857.

BRITISH MUSEUM

I. *A Vocabulary of the Dialect spoken by the* TODAS *of the* NILAGIRI *mountains. By the Rev.* F. METZ *of the German Evangelical Mission.*

[*Continued from* Vol. I. p. 146.]

I.

I (personal pronoun) ఆన్. *án.*
Ibex బరార్. *barár.*
Ice అర్ర్. *arr.*
Idle సోమారి. *sómári.*
Ichneumon కీర్ పెష్క్. *kírpeshk.*
If యోర్ or నోర్. *yór or nór.*
Illness నూఫ్. *núf.*
Impede బలిగ దెర్ష్బిని. *baligadershbini.*
Impotent, (verb imperson.) బుడివార్ష్విచి. *buḍivárshvichi.*
Improper సరి ఆఖడి. *sariákhadi.*
Improve ఉల్తాయిస్బిని. *uḷtáyisbini.*
Impure జిపిజ్. *jipij.*
Incense డూప్. *dúp.*
Increase బెళెదువెర్ష్బిని. *beḷeduvershbini.*
Indecent నానిల్లాడె. *nánilláde.*
Inflamation కావ్. *káv.*
Infant female మినిక్. *minik.*
Infant male పోపన్. *pópan.*
Informer జాడికారన్. *jáḍikáran,* మోరెకారన్. *more-káran.*
Insufficient యెత్తియాడి. *yettiyádi.*
Ink కరి. *kari.*
Insensible నానం అరివిచి. *nánam arivichi.*

Insane — పుచ్ఛ్ హిడిద్విచి. *puchch hiḍidvichi.*

Interest — బడ్డి. *baḍḍi.*

Inward — ఉళ్వళ్. *uzhvazh.*

Ire — బిజ. *bija.*

Iron — కబ్బున్. *kabbun.*

Itch — గజ్జి. *gajji.*

Iris of the eye — కణ్ణ్ మొఖ్. *kaṇṇ mokh.*

J.

Jackal — నరి. *nari.*

Jack fruit — పర్షవుపోం. *parshavupóm.*

Jest — నార్బిని. *nárbini,* గుత్సెర్ష్బిని. *gutsershbini.*

Join — కూట్స్బిని. *kúṭsbini.*

Journey — పయణ. *payaṇa.*

Joy — వొళ్స్తి. *voḷsti,* చచ్ఛోష్. *chachchósh.*

Jug — అడిగి. *aḍigi.*

Juice — కర్ర్. *karr.*

Jump — ఎల్థివెర్ష్బిని. *elthivershbini.*

Justice — నాయం. *náyam.*

K.

Keep — కాట్స్బిని. *káṭsbini.*

Key — టేర్ప్. *terp.*

Kick — బఫ్థ్బిని. *bafthbini.*

Kill — బేష్త్వెర్ష్బిని. *béshtvershbini.*

Kind (noun) — మాదరి. *mádari.*

Kindness — దయం. *dayam.*

Kindred — పైయాళ్. *paiáḷ.*

King, Gentleman — అరస్. *aras.*

Kiss — బిర్వెర్ష్బిని. *bírvershbini.*

Knee — మిగ్ము. *migmu.*

Kneel — మిగ్ము ఊర్స్బిని. *migmu úrsbini.*

Knock — కుట్ట్హివెర్ష్బిని. *kuṭṭ'hivershbini.*

Know — అర్ద్బిని. *arthbini.*

Knife — జూరి. *júri.*

L.

Ladder — యేనిళ్. *yénil.*

Lake — కేర్. *kér.*

Language — బాష్. *básh.*

Large — ఎతుడ్. *etuḍ.*

Late — తడెయాయి. *taḍeyáyi.*

Law suit — పిరియాది. *piriyádi.*

Lead (noun) — తీసలు. *tísalu.*

Leap — ఎళ్దివెర్ష్బిని. *elthivershbini.*

Leaf — ఎఴ్. *ezh.*

Leather — తూవఴ్. *túvazh.*

Leave — బుట్ట్ విట్ట్స్బిని. *butt'h viṭṭ'hsbini.*

Leech — ఎపుఫ్. *epuf.*

Left — ఎడ్డ. *eḍḍa.*

Leg — కాళ్. *kál.*

Lemon — యిఴ్మిచ్చ్. *yizhmichch.*

Leopard — కిర్మెన్. *kirmen.*

Leprosy కుట్హ్నూఫ్. *kuṭṭ'hnúf.*

Liar పెర్కితి. *perkiti.*

Lie down వొరక్హెని. *vorak'heni,* వొరక్హ్స్బిని. *vorak'hsbini.*

Life తీవ్. *tív.*

Lift up టూఖ్స్బిని. *túkhsbini.*

Lime, chalk నూర్. *núr.*

Limit, boundary తెవరు. *tevaru.*

Lips క్వీఝ్వాయి. *kwizhváyi,* మేల్వాయి. *mélváyi,* under and upper lip.

Listen వోరాట్స్బిని. *vóráṭsbini.*

Little యెడ్డి. *yeddi.*

Lizard వోశి. *vóṣi,* కెజల్సూన్. *kejalsún.*

Load పర్ర. *parra.*

Lock, key తెర్ప్. *terp.*

Long నెర్రిగిత్తి. *nerrigitti.*

Look నోట్స్బిని. *nóṭsbini.*

Loosen బిసెర్ష్బిని. *bisershbini,* బుట్హ్యిట్హ్స్బిని. *butt'h yiṭṭ'hsbini.*

Loud వుళ్కిగదార. *vuḷkigadára.*

Louse పేన్. *pén.*

Love పేర్వెర్ష్బిని. *pérvershbini.*

Lust ఆవెల్. *ável.*

Lake కేర్. *kér.*

Labour, work, (verb) గీర్థ్బిని. *gírthbini.*

M.

Mad — పెరడ్. *perad,* పుచ్చన్. *puchchan.*

Make — మాడ్థ్బిని. *máḍthbini.*

Malediction — పర్థిటి. *parthiti.*

Malice (I have) — కణ్ణకార్థ్బిని. *kaṇṇakárthbini.*

Man — ఆళ్. *áḷ.*

Mango — మాఫ్మేన్పోం. *máfménpóm.*

Many — ఉపాం. *upám.*

Marry — మెథ్వెర్ష్బిని. *methvershbini,* యెనగ్ కుఖ్ కాటెర్ష్బిని. *yenag kukh kátershbini.*

Marriage — మెథ్. *meth.*

Marsh, swamp — కెన్నేర్. *kennér.*

Mat — మందరి. *mandari.*

Matter — గీఫ్. *gíf.*

Meat — బువడ్. *buvaḍ.*

Measles — చిక్కమ్మ. *chikkamma.*

Medicine — మడ్డ్. *madd.*

Meet — ఎరాచ్కడ్డెర్ష్బిని. *eráchkaḍḍershbini.*

lit. I see half way.

Melt — కర్గ్స్బిని. *kargsbini.*

Milk (noun) — పాఴ్. *pázh.*

Milk (verb) — కర్ర్స్బిని. *karrsbini.*

Miscarry — మొఖ్బుడడ్వెష్చి. *mokhbuḍadweshchi.*

lit. the child has fallen down.

Might — దడ్డం. *daddam.*

Mist మజ్జ్. *majj.*

Mind మనసు. *manasu.*

Mind to ఉన్స్బిని. *unsbini.*

Miser కరి. *kari.*

Mock కొంస్బిని. *komsbini.*

Mocking కొంజాన్. *konján.*

Money పణం. *paṇam.*

Moment యిన్నర్గల్లి. *yinnargalli.*

Monkey కోడన్. *kóḍan.*

Moon తిగ్గళ్. *tiggal.*

Month తెల్దు. *teldu.*

Morning బెళితాష్. *beḷitásh.*

Morrow to మకాళ్. *makáḷ.*

Mother అవ్వ్. *avv.*

Motherless, orphan తొబ్బరిమొఖ్. *tobbarimokh.*

Mourn ఆట్స్బిని. *áṭsbini.* (lit. I play.)

Mouse యిఴ్. *yizh.*

Mouth బొయి. *boyi.*

Muscle నర్బు. *narbu.*

Mount హత్తిబోకెన్. *hattibóken,* మొక్బోకెన్. *mok-bóken.*

Mountain బన్న. *banna,* దాల్త. *dálta,* మర్ష్. *marsh.*

Must బేక్. *bék.* must not కుళ్ళ. *kuḷḷa.*

Mute బొక్క్. *bokk.* Be quiet, బొక్కిర్. *bokkir.*

N.

Nail	యిఴ్. *yizh.*
Naked	బథుగుపి. *bathugupi.*
Name	పేర్. *pér.*
Narrative	కథ్. *kat'h.*
Nation, tribe	కుళ్. *kuḷ.*
Naught (it is)	యేనమాడది. *yénamáḍadi.*
Navel	బుక్కు. *bukku.*
Near	కెఖురి. *kekhuri.*
Neat	నార్ష్టి. *nárshti.*
Neck	నాడి. *náḍi.*
Needle	ఎబ్బ్. *ebb.*
Neighbour	నెరబాల్తి ఆళ్. *nerabálti áḷ.*
Nest	గూడ్. *gúḍ.*
Never	ఎట్వను. *etwanu.*
New	పుథు. *puthu.*
News	సుద్ది. *suddi.*
Nickname	కాస్ పేర్. *káspér.*
Night	కగ్గార్. *kaggár.* dark యిఴిల్ట్. *yzhilt.*
Nine	ఉన్బొథ్. *unboth.*
Nineteen	పోన్బొథ్ *pónboth.*
Ninety	ఏన్బొథ్. *énboth.*
Noise	దని. *dani.*
Noon	ఉష్కి. *ushki.*

North బడగు. *baḍagu.*

Nose మితుఫ్. *mituf.*

Nostrils మితుఫ్తిల్తి. *mituftilti.*

No, not ఆడది. *áḍadi.* (అ with a shake of the head.)

Nothing, for పెరాది. *perádi.*

Nourish తాడెర్ష్బిని. *tádershbini.*

Now ఏని. *éni.*

O.

Oath I make బర్థ్బిని. *barthbini,* సత్యమాడ్స్బిని. *satya-máḍsbini.*

Ocean సౌందురు. *sounduru.*

Oil ఎంణ్ణై. *eṇṇai.*

Old పార్ర్. *párr.*

Omen సగుని. *saguni.*

One వొడ్డ్. *vodd.*

Onion ఊల్డి. *úḷdi.*

Open తర్ర్స్బిని. *tarrsbini.*

Once ఉన్నర్. *unnar.*

Orient మూది. *múdi.*

Order, to అపణెమాడ్స్బిని. *apaṇemáḍsbini.*

Other యింనొడ్డ్. *yinnodd.*

Outside పొర్ర్మొచ్. *porrmoch.*

Over మొక్. *mok.*

Owl గుంమన్. *gumman.*

Ox ఎష్ట్. *esht.*

P.

Pain — పాద్థ్తి. *pádthti.*

Palace — కువట్. *kuvaṭ.*

Palate — కిర్ర్నాలంగి. *kirrnálangi.*

Paper — కాగచ్. *kágach.*

Parasite — దిబిటి. *dibiṭi.*

Part — పాలు. *pálu.*

Passion — బిజ్జు. *bijju.*

Path — కింనాల్దార్. *kinnáḷdár.*

Pawn — బెక్క్. *bekk.*

Pawn, verb — బెక్క్తష్క్కెన్. *bekktashken.*

Peaceful — ఉళ్త్. *uḷt.*

Peacock — మిర్ష్. *mírsh.* (with the teeth shut) vide hare మిర్ష్.

Pearl — ముత్తు. *muttu.*

Pen, feather — తూఫ్. *túf.*

Penis — బుడి. *buḍi.*

Pepper — పెర్కి. *perki.*

Perspiration — ఉరి. *uri.*

Perish — కేడావెర్ష్బిని. *kéḍávershbini.*

Piece — తుండు. *tunḍu.*

Pig — పద్ది. *paddi.*

Pilfer — కడదివెర్ష్బిని. *kaḍadivershbini.*

Pinch — నెర్బ్స్బిని. *nerbsbini.*

Pipe — క్వేఴ్ష్. *kwézhsh,* క్వేఴ్త్. *kwézht.*

Piss పిస్కెత్వ ష్కెన్. *pisketvashken.*

Pit కుడి. *kuḍi.*

Place తావు. *távu.*

Plantain పావోం. *pavóm.*

Play ఆట. *áṭa.*

Play, verb ఆట్స్బిని. *áṭsbini,* నార్స్బిని. *nársbini.*

Plenty ఉపాం. *upám.*

Pledge పొన్ను. *poṇṇu,* (verb) పొన్నుగారనాయిస్బిని. *poṇṇugáranáyisbini.*

Plough నేఖెల్. *nékhel.*

Plough, verb ఉజ్థ్బిని. *uzhthbini.*

Pocket కువష్. *kuvash,* కిర్ర. *kirra.*

Point out కాట్స్బిని. *kátsbini.*

Poison నంజు. *nanju,* బిస్సం. *bissam.*

Pond కేర్. *kér.*

Poor కెలెఆళ్. *keleáḷ,* బేడుగారన్. *Béḍugáran,* బడువన్. *baḍuvan.*

Potter కుమ్మారన్. *kummáran.*

Porcupine ముళ్ళంది. *muḷḷandi.*

Pour అట్ట్స్బిని. *aṭṭ'hsbini.*

Portion పాలు. *pálu.*

Post to నిల్లిస్బిని. *nillisbini.*

Prepare వొళ్గెసిట్ట్స్బిని. *voḷtgesiṭṭ'hsbini*

Pride కువఫ్. *kuvaf.*

Pray పర్థ్స్బిని. *parthsbini.*

Property ఆస్తి. *ásti.*

Prostrate అడ్డబుధ్బిని. *aḍḍabudthbini.* కాల్మేల్బుధ్బిని. *kálmelbudthbini.*

Proud కువఫస్తి. *kuvafasti.* (it is pride).

Prove రుజగేర్ష్బిని. *rujagershbini.*

Pull బట్స్బిని. *batsbini.*

Pulse కైనాటి. *kaináti.*

Purchase బెలెగ్వొట్యెట్స్బిని. *belegwotyetsbini.*

Purge బిరుట్ఠెవిచి. *bíruṭṭ'hevichi.*

Purse కైటీరం. *kaitíram.*

Push తళ్ళిస్బిని. *taḷḷisbini.*

Putrid (it is) కొడుడువిచి. *koḍuduvichi.*

Pygmy కురుడ్. *kuruḍ.*

Q.

Quake అఫ్ధ్బిని. *afdthbini.*

Quick బెరెంద్. *berend.*

Quench, spoil కెట్ఠ్స్బిని. *keṭṭ'hsbini.*

Quite యెల్లా. *yellá.*

R.

Rage (verb) బిజవెర్ష్బిని. *bijavershbini.*

Rain మా. *má.*

Rain (verb) ఊడుతి. *úḍuti.*

Rainbow కువర్ వొర్ర్వర్ష్. *kuvar vorrvarsh.*

Raise టూఖ్స్బిని. *túkhsbini,* ఎట్స్బిని. *ettsbini.*

Raspberry ముళ్పోం. *muzhpóm.*

Recite	బిందివెర్ష్బిని. *bindivershbini.*
Recollection	నెప్పు. *neppu.*
Run	వోట్స్బిని. *vóṭsbini.*
Rat	యిఴ్. *yizhzh.*
Razor	తర్ష్వాళ్ట్. *tarshvált.*
Reconcile	వొద్దెగెర్ష్బిని. *voddegershbini.*
Red	కెప్పు. *keppu.*
Refuse	కుళది ఎష్ట్స్బిని. *kuḷadi eshtsbini.*
Regulate	సరిమాడ్స్బిని. *sarimáḍsbini.*
Release	బుట్ట్వెర్ష్బిని. *buṭṭ'hvershbini.*
Require	బేకెష్ట్స్బిని. *békeshtsbini.*
Rend, tear	కీరివెర్ష్బిని. *kírivershbini.*
Rhododendron	బిర్ష్మేన్. *birshmén.*
Rheumatism	సణి. *saṇi.*
Rib	మురిఎల్ఫ్. *murielf.*
Riches	ఎటుద్ ఆస్తి, *etud ásti.*
Right	సరి. *sari.*
Right hand	బఴ్కై. *bazhkai.*
Ring	ఎబ్బళ్. *ebbal.*
Rise	ఎడదెర్ష్బిని. *eḍadershbini.*
River	పా. *pá.*
Road	ఆళ్దార్. *áḷdár.*
Roar	కెంద్ధ్బిని. *kenddhbini.*
Rock	అర్రె. *arre.*
Roof	బర్రి. *barri,* వర్రి. *varri.*

Root — బేర్. *bér.*

Rope — హగ్గం, *haggam,* కంణి. *kaṇṇi.*

Rose — కడెగ్పూఫ్. *kaḍegpúj.*

Rotten — కెతలావిచి. *ketalávichi.*

Rub — కీత్స్బిని. *kítsbini.*

Rubbish — గెబ్బు. *gebbu.*

Ruminate, 3d. pers. — మేల్గెర్చి. *mélgerchi.*

Run away — వోడ్స్బిని. *vóḍsbini.*

Rust — బొర్గ్. *borg.*

Rusty (it is) — బొర్గెవిచి. *borgevichi.*

S.

Sack — తీరం. *tíram.*

Salep plant — తిర్కల్తూర్. *tirkaltúr.*

Saliva — యెజ్జలు. *yejjalu.*

Salt — ఉప్పు. *uppu.*

Salute — కుబ్బుట్టిఖెన్. *kubbuṭṭ'hikhen,* సలాంగెర్ష్బిని. *salámgershbini.*

Sand — ఏర్మోల్. *érmol.*

Saturday — శని. *sani.*

Satisfied (not hungry) — బీర్వఖ్స్విచి. *bírvakhsvichi.*

Sauce, curry — కారం. *káram.*

Scatter — బీరివెర్ష్బిని. *bírivershbini.*

Scratch — కుల్తూరెర్ష్బిని. *kuḷtúrershbini,* ఎత్స్బిని. *ets bini.*

Scent — మూద్థ్తి. *múdthti.*

Scent, imperson. — మూక్వెర్ష్చి. *múkvershchi,*

Scorpion — కిర్ర్షూర్. *kirrshúr.*

Scull — మద్దెల్లు. *maddellu.*

Seal — ముదురుం. *mudurum.*

See — నోట్స్బిని. *nóṭsbini.*

Sell — మారివిట్ఠికెన్. *mariviṭṭ'hiken.*

Seize — బట్స్బిని. *batsbini.*

Send — బోఖెద్దేష్ట్స్బిని. *bókheddeshtsbini.* (go I say)

Sentry — కావల్గారన్. *kávalgáran.*

Set (the sun sets) (బీఴ్) బిడిదువెత్ఛి. *(bízh) biḍidu-vet'hchi.*

Seven — య్ఝేఴ్. *yzhézh.*

Seventeen — పార్ర్. *párr.*

Seventy — ఏఴ్ఝొథ్. *ézhzhoth.*

Sew — కుత్కూట్స్బిని. *kutkúṭsbini.*

Shade, shadow — నేర్ష్. *nérsh.*

Shake — అలిక్స్బిని. *aliksbini.*

Shame — నానం. *nánam.*

Shameless — నానిల్లాదె. *nánilláde.*

Shave — బాన్స్బిని. *bánsbini.*

She — అథ్. *ath.*

Shell — తెంగి. *tengi.*

Ship — కబల్. *kabal.*

Short — కుర్గిటి. *kurgiti.*

Shoulder — నెబ్కోడ్. *nebkóḍ.*

Show — కాడ్స్బిని. *káḍsbini,* neuter తువర్ష్చి. *tuvarshchi.*

Shrub — డొబ్బి. *dobbi.*

Shut	ముచ్విట్ట్స్బిని. *muchviṭṭ'hsbini.*
Sick	బార్ధ్బిని. *bárdthbini.*
Sickle	కాడర్తి. *káḍarti.*
Side	బిర్ష్క్. *birshk.*
Sigh	నరిగిస్బిని. *narigisbini.*
Sight	నోట్. *nóṭ.*
Sign	గుర్త్. *gurt.*
Silent, I am	బొతేర్ష్బిని. *botershbini.*
Silver	బిళ్తి. *biḷti.*
Sin	పాపం. *pápam.*
Single	వొద్ది ఆళ్. *voddiál.*
Sister	ఎన్నోర్వెత్కుఖ్. *ennorvetkukh.*
Sit	ఎర్ష్కెన్. *ershken,* ఎతర్స్బిని. *etarsbini.*
Six	ఆరు. *áru.*
Sixteen	పేళ్. *pézh.*
Sixty	ఆరొథ్. *ároth.*
Skin	తువర్ష్. *tuvarsh.*
Sky	బాన్. *bán.*
Slay	బీష్కెర్ష్బిని. *bíshkershbini.*
Sleep	వొర్ఖెన్. *vorkhen,* వొర్ఖ్స్బిని. *vorkhsbini.*
Slide, slip	ఎఖ్ఖివెర్ష్బిని. *ek'hk'hivershbini.*
Slippery (it is)	ఎఖ్ఖిచి. *ek'hk'hichi.*
Slope	వోరె. *vóre.*
Slow	మెల్లి. *melli.*
Small	శినుద్. *sinud.*

Smarts, it — వాస్చి. *váschi.*

Smell (good) — ద మొతి. *damoti.*

Smell, bad — జిడివొతి. *jiḍivoti.*

Smile — కార్ద్థ్బిని. *kárdthbini.*

Smoke — పొఖ్. *pokh.*

Snake — పాబ్. *páb.*

Sneeze — తిపెర్ష్బిని. *tipershbini.*

Snore — కర్స్బిని. *karsbini.*

So — యింగై. *yingai,* అంగై. *angai.*

Son — మొఖ్. *mokh.*

Sorcerer — బిలికారన్. *bilikáran.*

Sorcery (he practices) వొర్ష్చి. *vórshchi.* the Curumba enchants. కుర్ఫ్ వొర్ష్చి. *Kurf vórshchi.*

Soul — ఉస్సురు. *ussuru,* జీవ్. *jív.*

Soil — బుమి. *bumi.*

Sour (it is) — బుళ్త్సడె. *bulṭsade.*

Sorry, I am — దుఖం ఎర్ష్బిని. *dukham ershbini.*

South — తెక్కు. *tekku.*

Sow, I — బుత్త్స్బిని. *buttsbini.*

Speak అర్వొద్థ్బిని. *arvodthbini,* అర్వొర్ష్బిని. *arvorshbini.*

Spear — యిత్త్. *yiṭṭ'h.*

Spend — బీసెర్ష్బిని. *bísershbini.*

Speech — బాష్. *básh,* పర్స్ంగ్. *parsng.*

Spine బేనుబ్. *bénub.*

Spittle దివొన్. *divon,* దివొటి. *divoti.*

Spit దివొర్ష్బిని. *divorshbini.*

Spider ట్వాల్జెన్. *twáljen.*

Spoil కెడిచెర్ష్బిని. *kedichershbini.*

Spot తావ్. *táv,* తాఫ్. *táf.*

Staff కోలు. *kólu.*

Stand నెల్ల్స్బిని. *nellsbini.*

Star మీన్. *mín.*

Spread బీర్స్బిని. *bírsbini.*

Sprinkle గిట్స్బిని. *gitsbini.*

Squeeze నెర్బస్బిని. *nerbasbini.*

Squeak బిల్ట్స్బిని. *biltsbini.*

Starve బీర్ ఏర్ద్థ్టి. *bír érdthti.*

Steal కడెదువెర్ష్బిని. *kaḍeduvershbini.*

Steel ఉష్క్. *ushk.*

Steep డాళ్ట్. *dáḷt.*

Stench జిడి. *jiḍi.*

Stink జిడిబుట్ట్హ్స్బిని. *jiḍibuṭṭ'hsbini.*

Step (noun) హెజ్జె. *hejje.*

Sting కుద్థ్వెర్ష్బిని. *kudthvershbini.*

Stool (to go to) ట్వార్ష్బోకెన్. *twárshbóken.*

Stone కల్ల్, *kall.*

Stop పార్వద్థ్బిని. *párvadthbini.*

Storm కాట్. *kát.*

Straw — ముర్థ్. *murth,* పుల్లు. *pullu.*
Stream — పా. *pá.*
Strike — పుయిస్బిని. *puyisbini.*
String — నారు. *náru.*
Strong (man) — తాత్ మొరాళ్. *tátmoráḷ.*
Suck (calf) ఎక్ స్తి. *ek'hsti,* (child) మొష్ ఊట్యితి. *morsh úṭyti.*
Sugar — కబొటి. *kaboṭi.*
Sun — బిళ్. *bízh.*
Sunday — ఆడ్స్వోం. *ádsvóm.*
Sure — నేజాని. *néjáni.*
Swallow — నుగ్గివిట్ట్స్బిని. *nuggiviṭṭ'hsbini.*
Swamp — కెం నేర్. *kennér.*
Sweat — ఉరి. *uri.*
Sweep — దండెర్ష్ బిని. *dandershbini.*
Sweet — దిజతి. *dijati.*
Swell — బాద్థ్చి. *bádthchi.* (it swells.)
Tail — బార్ష్ం. *bárshm.*
Take — తెగ్స్బిని. *tegsbini,*
Tall నిర్రిగితి. *nirrigiti;* I am tall, నిర్రిగివెర్ష్బిని. *nirrigivershbini.*
Talk — ఎష్ట్స్బిని. *eshtsbini.*
Tamarind — బుళ్తి. *buḷti.*
Tax — బేర్వన్. *bérvan.*
Thatch — పుల్లుబేర్స్బిని. *pullubérsbini.*
Tempest — కాత్. *kát.*

Ten	పథు. *pathu.*
Thirst	నీర్ఖాస్తి. *nírkhásti.*
There	అల్లి. *alli.*
Thief	కళ్ళన్. *kaḷḷan.*
Thirteen	పొన్మూడ్. *ponmúḍ.*
Thirty	ముబొత్. *muboth.*
Tie	కట్ట్హస్బిని. *kaṭṭ'hsbini.*
Thorn	ముళ్ట్. *muḷt.*
Thistle	నెఖ్. *nekh.*
Thread	నూఴ్. *núzh.*
Three	మూడు. *múḍu.*
Thumb	బెవెళ్. *beveḷ.*
Thunder	ఎర్రి. *erri.*
Thunders, it	ఎర్రిఎర్ద్థ్తి. *errierdthti.*
Time	కాల్. *kál.*
Tiger	బీర్ష్. *bírsh.*
Tinder	తూధి. *túdhi.*
Tobacco	బొఖ్. *bokh,* బఖ్. *bakh.*
Token	కుర్ప్. *kurp.*
Toll, custom	సుక్కం. *sukkam.*
Tongue	నాఫ్. *náf.*
Tooth	పర్ర్ష్. *parrsh.*
Touch	ముట్ట్హస్బిని. *muṭṭ'hsbini.*
Tower	గోపురు. *gópuru.*
Town	ఊర్. *úr.*
Transgression	త్వర్ర్. *twarr.*

Trap — గూడు. *gúḍu.*
Treasure — బత్థక్. *bathak.*
Tree — మేన్. *mén.*
Tremble — వోఫ్స్బిని. *vófsbini.*
True — నేధాని. *nédháni.*
Trust — నబ్బ్స్బిని. *nabbsbini.*
Truth — సత్యం. *satyam.*
Tumble — బుదుదువెర్ష్బిని. *bududuvershbini.*
Turban — మండెపారి. *mandepári.*
Tusk — కొబ్బు *kobbu.*
Turn — తిర్క్స్బిని. *tirksbini.*
Twelve — పొంనెడ్. *ponneḍ.*
Twenty — ఎవొథ్. *evoth.*
Twig — మేన్కొబ్బు. *ménkobbu.*
Twilight — నడుజామ. *naḍujáma.*
Twin — ఎంమొర్మొఖ్. *emmormokh.*
Twinkle — కణ్ణుకూట్స్బిని. *kaṇṇukúṭsbini.*

U.

Udder — మొర్ష్. *morsh,* మొఴ్. *mozh.*
Ulcer — పుణ్ణు. *puṇṇu.*
Ugly — ఆఢది. *ád'hadi.*
Umbrella — క్వర్. *kwar.*
Uncertain — నెల్లిల్లె. *nellille.*
Uncle — ఎన్నేన్పెరుద్. *ennénperud,* ఎంనేన్కెరుద్. *ennénkerud.*
Under — ఎర్క్. *erk.*

Up	మొక్. *mok.*
Urine	ఉచ్చె నీర్. *uchchenír.*
Understand	అర్ద్థ్బిని. *ardthbini.*
Unjust	నాయంయి ల్లాదె. *náyam yilláde.*
Urge	బలంగదెర్ష్బిని. *balamgadershbini.*

V.

Vagaband	పరదేశ్. *paradés.*
Value, price	బెల్లె. *belle.*
Vegetable	సొప్పు. *soppu.*
Venereal	సూళి. *súḷi.*
Vertex	మద్ద్నెరెన్. *maddneren.*
Vial	పుట్ఠి. *puṭṭ'hi.*
View	నోట్. *nóṭ.*
Violence	బలం. *balam.*
Voice	దని. *dani.*
Vomit	తాద్వెర్ష్బిని. *tádvershbini.*
Village	హట్ఠి. *haṭṭ'hi.*

W.

Wait	కాతెర్ష్బిని. *kátershbini.*
Walk	నడెద్స్బిని. *naḍedsbini.*
Wall	గోడి. *góḍi.*
Want, famine.	పంజం. *panjam.*
Want, I	యెనగ్ బేకదె. *yenag békade.*

War — జగళ. *jagaḷa.*

Warm, I — బెంద్వెర్ష్బిని. *bendwérshbini.*

Wart — జట్ఠు. *jaṭṭ'hu.*

Wash — తువత్స్బిని. *tuvatsbini,* అర్ష్బిని. *arshbini.*

Waste — కెట్ఠ్సిహాక్స్బిని. *keṭṭ'hsiháksbini.*

Water — నీర్. *nír.*

Wax — మెష్క్. *meshk.*

Way — ఆళ్దార్. *áḷdár.*

Weak — అల్పెర్ష్బిని. *alpershbini.*

Wear — బూత్స్బిని. *bútsbini.*

Wealth — ఆస్తి. *ásti,* బథ్క్. *bathk.*

Wed — మెథగెర్ష్బిని. *methagershbini.*

Week — ఎట్ఠ్నాళ్. *eṭṭ'hnáḷ.*

Weigh — తూక్స్బిని. *túksbini.*

Well — బావి. *bávi.*

Well, good — ఉళితు. *uḷitu.*

West — మోక్. *mok.*

When — ఎత్వన్. *etvan.*

What — ఏనుం. *énum.*

Wet — నాద్. *nád.*

Wheat — గోదుబి. *gódubi.*

Whistle, I — నెల్ద్థ్బిని. *neldthbini.*

Where — యెల్లి. *yelli.*

Whip చబక్. *chabak.*

Whiskers మొయి. *moyi.*

White బెళ్ప్. *beḷp.*

Who ఆరియో. *áriyó.*

Whore చ్జూవి. *chzhúvi.*

Wide అగలు. *agalu.*

Widow ముద్దెగిత్తి. *muddegitti.*

Widower బరుడ. *baruḍa.*

Wife కుయిగ్యో. *kuyigyó,* అకుఖ్. *akukh.*

Willow బఖ్మేన్. *bakhmén.*

Wind కాటు. *kátu.*

Wipe వర్ర్ద్థ్బిని. *varrdthbini.*

Wilderness అర్గాడ్. *argáḍ.*

Wing డెర్కి. *derki.*

Wink, I కైఎష్ట్స్బిని. *kaieshtsbini.*

Witchcraft పిలి; *pili,* సూని. *súni.*

Wish ఆసె. *áse.*

With నెర. *nera.*

Wither వొనగెర్ష్బిని. *vonagershbini.*

Without పొర్ర్ముట్. *porrmut.*

Within ఉళ్ట్. *uḷt.*

Witness సాకిచి. *sákichi.*

Woman కుఖ్. *kukh.*

Wood, forest క్వాష్. *kwársh.*

Word మాటు. *mátu.*

Work, I కెల్లస్ గెష్ బిని. *kellasgershbini.*

Worm పుఫ్. *puf.*

Y.

Yard ఎంమగై. *emmagai,* ½ yard వొంమగై. *vommagai.*

Yawn ఆబిట్ట్హ్స్బిని. *ábiṭṭ'hsbini.*

Year కువర్. *kuvar,* ఉవఴార్. *uvazhár.*

Yes హా. *há,* అత్తనాడి. *attanádi.*

Yesterday ఎంనేర్. *ennér.*

Yield వొబ్బిస్బిని. *vobbisbini.*

Yoke నొఖున్. *nokhun.*

Young మొఖ్వష్ఆళ్. *mokhvarṣháḷ.*

The verbs I have always written in the 1st person singular, because with several verbs I was not quite sure how far the radix extends.

As the Todas very often do not pronounce their words distinctly enough for a foreigner, it is possible that I may have exchanged the following letters for each other ఱ (ற)—*r̤r̤* for ర (ர)—*r*, ఴ (ழ)—*zh* for శ —*ṣ* or ష—*sh*, ట —*ṭ* for డ —*d* etc.

The more accurate I wish to be, the more difficult I find it to reduce the Toda language to writing.

II. *A Memoir on the Ancient Reservoirs at Aden. By* LIEUT. R. L. PLAYFAIR, *of the Madras Artillery, Assistant Political Resident, Aden.*

THE expedient of constructing reservoirs in which to collect and store rain water, has prevailed in Arabia from the remotest antiquity, these are generally found in localities devoid of perennial springs, and dependant on the winter rains for a supply of water during the summer months; or in those insular positions which are cut off from the copious torrents, that descending from the mountains, fertilize the Teháma of Yemen, and in the beds of which a constant supply of pure water may be procured by digging, a few feet below the surface of the soil.

The first and most remarkable instance on record is the great dam of Máreb, attributed by Aboo'l-Féda to Abd-esh-Shems surnamed Sába, who founded the city from him named Sába, and afterwards Máreb.

Other historians however assign to it an earlier origin, and it is related that Lokman, king of that remnant of the Adites who had renounced idolatry at the preaching of the Prophet Húd, and who are usually called the second Adites, took up his abode about B. C. 1750 in the region of Sába.

This country was frequently ravaged by impetuous mountain torrents, while at other times it was parched for want of a sufficient supply of water, in order therefore to remedy these evils, he conceived the idea of building a dam across the gorge of a valley contained between two mountains, which he thus converted into a vast reservoir of five leagues in length, for the reception of the rain water descending from the hills.

The dam was built of cut stone, secured by iron or copper cramps, and cemented with bitumen, forming a prodigious mass of masonry, 300 cubits broad, 120 feet high, and two miles in length; it was provided with thirty sluices, through which the water was convey-

ed into canals for the irrigation of the fields and gardens of Máreb, and by means of which, that city became what Pliny styled it, "the mistress of cities, and the diadem on the brow of the universe."

The dyke having somewhat suffered from the lapse of time, was repaired and consolidated by the Himyarite Queen Balkís, about the commencement of the Christian Era, and in her time it was deemed too strong ever to be destroyed.

That catastrophe did however at length take place, the dam which had stood for 1700 years, yielded to the pressure of water from within, and gave way, deluging the country far and wide, and carrying away the whole city with the neighbouring towns and people; and thus the prosperity of Máreb was destroyed.

This event took place about A. D. 120, and is famous in Arabian History as the "*Sail-el-Arim*" or "*rush of water from the reservoir*" by which name it is mentioned in the Korán.

M. Arnaud, a French traveller, reached Máreb in 1843 after a difficult and arduous journey, and succeeded in obtaining measurements for a plan of this famous dyke, which I believe he has since published; according to his account, it was situated between two hills named Balak, which, when joined, by the wall, formed the reservoir; the enclosed space is of such extent, that a shout from one end, could not be heard from the other, and the massive masonry, though rent here and there, still attests the original solidity of the work.

This doubtless suggested similar reservoirs in other parts of Arabia and the neighbouring coasts of Africa, which have usually been subject to it, and with the spread of the Kaliphate Westwards, the idea was introduced into Spain and other Mahomedan conquests.

The Reverend Mr. Stern, who succeeded in reaching Sanaa in September of this year, (1856) informed me that, during the whole of the route between that city and Menákhir, near Jebel Harraz, large and beautifully constructed cisterns occur, these during his visit were perfectly water-tight and contained a considerable supply of water, though partly filled up and choked with long rank grass.

This traveller did not observe any in the Teháma, probably they are not required there, as the softer nature of the soil admits of considerable absorption, whereby a sufficient supply of water can be obtained from wells.

Lieutenant Burton in his "First footsteps in Eastern Africa" describes several tanks and water-courses on the Island of Saad-ed-dín near Zailah, one of them is a work of some art, it consists of a long sunken vault with a pointed arch projecting a few feet above the surface of the ground, the exterior is of rough stone, and the inside is carefully plastered with fine chunam.

Mr. Salt describes a connected set of four reservoirs on the Island of Kútto, in the bay of Amphila, they are excavated in the form of a cross, each being thirty feet long, nine broad, and seven deep, lined with chunam, and together capable of containing about 120,000 gallons of water; a tradition current amongst the natives ascribes their construction to the Persians, who conquered Yemen from the Abyssinians early in the seventh century, and for some time held unrivalled possession of the commerce of the Red Sea.

The same traveller, in his previous voyage with Lord Valentia, discovered a number of similar cisterns in the Island of Dhalák near Massowah, but of larger dimensions, the natives have a similar tradition regarding their construction to that current at Kútto, they asserted that the original number was 316, but admitted that they had never seen more than thirteen or fourteen.

The Island of Massowah also contains a number of oblong tanks, some of which are of great extent, and are chiefly private property, the scanty supply of rain water which they contain, is kept under lock and key.

Captain Haines, in his Memoirs on the South coast of Arabia, mentions the discovery of several tanks amongst the ruins of Hosn Ghoráb, the cement of which was as hard as the solid rock, local tradition assigned the peopling of that district, and the construction of the buildings there, to a race whom he calls Koum Harmás, probably *Koum Hormuz* "people of Hormuz," or Persians, thus confirming, in a remarkable manner, the traditions recorded by

Lord Valentia and Mr. Salt, regarding the origin of the tanks on the Islands of Dhalák and Kútto.

Colonel Chesney mentions the fact of similar reservoirs undoubtedly of Saracenic origin, existing in Granada, Cordova, Seville and Gibraltar, these, from the perfection of their coating, continue to be water-tight, though some of them, as those under the Castle of Gibraltar, must have been in use upwards of seven centuries.

Two very remarkable cisterns exist in the ancient fortress on the summit of mount Agatha, in the Termino of Mercadel, in the Island of Minorca, the Moorish origin of which is attested by an Arabic inscription. These differ from those of Gibraltar, by being raised structures instead of excavations, and they are of much greater dimensions, being capable of containing 2173 tuns, or upwards of half a million gallons of water.

Numerous other instances might be cited, but with the single exception of the great dam of Máreb, none equal the magnificent series lately discovered at Aden, which, when restored, will probably contain not less than twenty or thirty million imperial gallons.

There is no certain record of the construction of the Aden reservoirs, and the natives of the place have no tradition regarding them in which they place much confidence. It is probable that some are of great antiquity, and that others were built as the necessity for them arose, or as the piety of individuals prompted them to construct some work, by which a great public benefit might be conferred upon their city. This latter supposition is supported by the fact, that under the domed entrance to one of them lately restored, a tomb, probably that of the founder, was discovered, and I have been given to understand that an inscription was removed from this tank by the late Surgeon Malcolmson, which probably would have afforded some clue to its history.

My impression is, that the construction of these reservoirs was first commenced after the second Persian invasion of Yemen, about A. D. 600, but of this fact we have no authentic record.

It is related by the Imám Alí ibn Hoosain-el-Khuzrají, that Melek-el-Mansoor Taj-ed-Dín Abd-el-Waháb ibn Táhir, sovereign

of Yemen, between his accession to the throne in A. D. 1472, and the great famine which decimated Yemen in A. D. 1502, built many religious edifices throughout the country, especially in Aden, amongst others, numerous reservoirs, aqueducts, &c. the most important of which was the aqueduct to convey the water of Bír Amhait into Aden.

There is also a tradition in Aden, that about A. H. 906 (A. D. 1500,) the Governor persevered in digging wells for sweet water, and being successful, the reservoirs were permitted to fall to ruins, or to be filled up with the *debris* washed down from the hills.

Probably the water obtained from these wells, and from the Bír Amhait, sufficed for the supply of the place, which had begun to decline in consequence of the Indian traffic having been diverted from its ancient channel, by the discovery of the route to Europe round the Cape of Good Hope, and the preservation and repair of the reservoirs became no longer a matter of pressing necessity.

The aqueduct above mentioned appears not always to have sufficed for the supply of Aden, (which continued, as late as the seventeenth century, to have a population of 30,000 souls,) as, in a Latin tract written by Resendius bearing date A. D. 1530 and entitled "Epitome Rerum Gestarum in Indiâ a Lusitanis," he remarks, "that the water was daily brought in on camels, which on some days amounted to 1,500 or 1,600 and even 2,000, and that if they came in the day time, the water was taken to the city, but if in the evening, it was deposited in a *large cistern near the water house.*"

The above extract is quoted by Mr. Salt, to prove that the aqueduct from Bír Amhait did not exist in the time of Resendius, but I think this conclusion hastily formed, as there is no reason to doubt the fact that it was constructed by Abd-el-Waháb ibn Táhir, and that the "*cistern near the water house*" was the large reservoir built at the Aden termination of the aqueduct, to receive the water of Bír Amhait.

This aqueduct and reservoir were in use when Aden was visited by a deputation of French merchants of St. Malo under M. de Merveille in A. D. 1708, and the remains of both were seen and de-

scribed by Mr. Salt himself in 1809, who describes the latter as being near a *Beit-el-ma* or *water house*, which formed a shelter for the natives who brought supplies into the town.

The remains of the aqueduct still exist, and those of the reservoir were only destroyed by our Engineers a few years ago, when constructing the Isthmus defences.

If then the aqueduct was not built during the visit of Resendius the object of the cistern on the Isthmus, in a position where it could never be filled by rain water, is not apparent, the more probable supposition is that water was brought in on camels during some temporary stoppage of the aqueduct, and that the local tradition which assigns the discontinuance of the use of the reservoirs for the reception of rain water to this period, is correct.

The following is the description given by Mr. Salt of the tanks within the crater of Aden :—" Amongst the ruins some fine remains of ancient splendour are to be met with, but these only serve to cast a darker shade over the desolation of the scene. The most remarkable of these remains consists of a line of cisterns situated on the N. W. side of the town, three of which are fully 80 feet square and proportionably deep, all excavated out of the solid rock, and lined with a thick coat of fine stucco, which externally bears a strong resemblance to marble ; a broad aqueduct may still be traced which formerly conducted the water to these cisterns, from a deep ravine in the mountain above ; higher up is another still entire, which at the time we visited it *(November)* was partly filled with water, in front of it, extends a handsome terrace formerly covered with stucco, and behind it rise some immense masses of granite, which being in some parts perpendicular, and in others overhanging it, formed during the hot weather a most delightful retreat.

Some Arab children who followed us in our excursions were highly pleased when we arrived at the spot, and plunging headlong into the water, much amused us by their sportive tricks."

When Captain Haines visited Aden in 1835 several of the reservoirs appear still to have been in a tolerable state of preservation ; besides the hanging tanks, or those built high upon the sides of the

hills, several large ones were to be traced round the town, but since the occupation of Aden by the British, no steps having, until lately, been taken to repair or to preserve them from further destruction, they became entirely filled up with stones and soil washed down by the rains, the people of the town were permitted to carry away the stones for building purposes, and with the exception of the hanging tanks above mentioned, which could not easily be destroyed or concealed, all trace of them was lost, save where here and there a fragment of chunam projecting above the ground, indicated the supposed situation of a reservoir, believed to be ruined beyond the possibility of repair.

About three years ago, Government sanctioned the repair of three of the tanks which appeared in the best state of preservation, and the result was so satisfactory that the Political Resident applied for, and obtained permission to restore the remainder. The task of superintending the work was entrusted to me, and I at first employed the convicts, and such free labor as the limited surplus of the Municipal funds, aided by the sale of the rain water collected, enabled me to command, permission was subsequently obtained for appropriating the quit rent on building grants, amounting to about eight hundred Rupees per annum, for this purpose.

At this time no idea was entertained that the tanks were so numerous and so vast as they subsequently proved to be, and it was believed that they could all be restored in the manner above described, without entailing any expense on the state: as the work progressed, and as day by day new discoveries were made, the impossibility of this became manifest, and Government was pleased to sanction the employment of the public funds to ensure the work being completed expeditiously and well.

At present much has been done and at a comparatively trifling expense, which will be more than repaid by the first heavy fall of rain, but much more remains to be done, and it will yet be years ere all the reservoirs are put in a serviceable condition.

I despair of being able, without a plan, to give such a description as will enable any one who has not seen, thoroughly to understand them.

A glance at the map of Aden will show, that the range of hills which forms the boundary of the crater, is nearly circular, on the outer or Western side, the hills are very precipitous and the rain water descending therefrom is carried rapidly to the sea by means of a number of long narrow valleys separate from each other.

On the inner, or Eastern side, the hills are quite as abrupt, but the descent is broken by a large table land occurring about midway between the summit and the sea level, which occupies about one-fourth of the entire superficies of the Peninsula.

This plateau is intersected by numerous deep ravines, nearly all converging from the Shumshum range into the Tawela valley, which thus receives about a quarter of the drainage of the Peninsula.

The steepness of the ravines, the hardness of the rocks and the scarcity of soil on them, all combine to prevent any great amount of absorption, and thus a very moderate fall of rain suffices to send a stupendous torrent of water down the valley, which, ere it reaches the sea, not unfrequently attains the proportions of an unfordable river.

The damage done by this torrent has frequently been considerable, during my residence in Aden I have seen kutcha houses, furniture, animals, and even human beings carried with irresistible velocity into the sea, and during a fall of rain which occurred at midnight on the 28th December 1842, so great was the rush of water that upwards of two hundred animals, were carried away, and nine men were missing in the morning, only three of whose bodies were ever found.

Rain to this extent is exceptional in Aden, but few years pass, during which many thousand tuns of water are not lost from want of means to retain it.

Our predecessors were more provident as the gigantic reservoirs, which occur chiefly in and near the main water-course, the Tawela valley, attest.

Most travellers have erroneously described them as excavated out of the solid rock, but I am not aware of any such. Those under

the foot of the hills are generally built at a re-entering angle of the rock, which promises a copious flow of water, here the soil has been carefully cleared away and a salient angle or curve of masonry built across it, while every feature of the adjacent rocks has been taken advantage of, and connected by small aqueducts, to ensure no water being lost.

The overflow of one tank is conducted into another, and thus I believe that a complete chain existed into the very centre of the town, where small tanks which could not otherwise be filled, are being daily discovered.

Their construction is extremely fantastic, the only principle which seems to have been adhered to, is the avoidance of straight lines, and the wisdom of this has been proved in the recent excavations, as in almost every instance where a straight line has existed, it has been forced in by the rush of water without it.

They are generally of stone and mud masonry, roughly plastered on the outside, and beautifully coated in the interior with chunam; flights of steps, gradients, platforms, &c. are heaped together and give an exceedingly grotesque appearance to the whole: each large tank has a smaller one in front of it, built for the purpose of retaining all earth and stones carried down by the torrent, and permitting a pure stream of water to flow into the reservoir beyond.

As before mentioned, the majority of the tanks are in and near the Tawela valley, which intersects and receives the drainage of the large table land under the Shumshum range. This valley is 700 feet in length from the point where it leaves the table land, to its actual junction with the level plain of the crater. The hills throughout its entire length are perpendicular, and at the head of the valley they meet, leaving barely sufficient room for one man to pass. The valley then gradually opens out, and at the gorge, it is one hundred and fifty feet in breadth, the hills then circling round to the right and left, form part of the walls of the crater of Aden.

Appendix A is a tabular statement of the various tanks which, together with the aqueducts leading to them, have been thoroughly repaired and are now ready to receive water.

No. 1 is at the top of the valley just described, and is formed by a wall drawn across it, connecting the hills on either side, precise-

ly similar to, but on a much smaller scale than, the great dam of Máreb.

The rocks within it have been coated with chunam to prevent leakage, above it is another large but natural tank which retains water during the greater part of the year, this was formerly inaccessible, but steps have now been cut, and hand rails and iron stanchions inserted in the rock, to facilitate communication with it.

No. 2 is situated lower down the valley, on the west or left side, and at some distance from No. 1, the intermediate space being occupied by the Tawela well; formerly no communication existed between them, but a broad paved aqueduct has now been constructed to answer the double purpose of preserving the water which may overflow from No. 1, and the drainage of the intermediate rocks.

No. 3 is immediately adjoining No. 2 and connected with it by means of a sluice near the top of the wall.

No. 4 is connected with No. 3 in the same manner, and its overflow is conducted into a large aqueduct thirteen feet in breadth, which runs down the centre of the valley, round the Bír Khalád into No. 8½.

No. 5 is situated on the east or right hand side of the valley, near No. 1, and opposite No. 3, it is extremely fantastic in construction, and has two deep wells in the centre, one of which is thirty-five feet in depth.

No. 6 is connected with the preceding by means of a slit in the rock which conveys the water into it.

No. 7 a tank of very similar construction, the overflow of which is carried by a branch aqueduct across the valley, into the main aqueduct, in which is situated the small tank No. 8½.

No. 8½ is, as above said, a small tank in the main aqueduct, built for the purpose of preventing the soil and stones washed down by the rain from falling into, and injuring the large one beyond it (No. 8): here the overflow of all the other tanks above it, meet so that no water descending from the hills can by any possibility escape, it must all flow into the main channel, at some point of its course.

No. 8 is a large reservoir through which the main aqueduct

flows; it was very much destroyed, one wall having been forced in, either from the pressure of water from without, after the tanks and aqueducts above it became ruins, or by the water finding its way inside the masonry and sapping its foundations. It has however been repaired, and I am sanguine that it will prove water-tight.

Thus far only the series is complete, beyond, the main aqueduct has not been finished, though it is in course of construction, and the other tanks, which are finished, have not been united.

One of the most remarkable is No. 11, which is a double tank situated below a deep rift in the hill, down which a great volume of water flows, but as if to make sure of its being filled, the drainage of the hill side behind it, is conveyed into it by an aqueduct leading through a small hole in the rock, not larger than a man's head. The entrance to this tank was originally domed, and contained an inscription which has been removed, the dome has been restored.

The other tanks which have been restored, require no notice.

Appendix B is a statement of all the remaining reservoirs which have been discovered, some of them are cleared out and nearly completed, others are in course of restoration, the rest have not been commenced: of these immeasurably the finest is that marked I. It is nearly a cylinder of one hundred and forty-eight feet in diameter but the depth has not yet been ascertained, about twenty-four feet have been cleared out, but the bottom has not been reached: into this reservoir, the overflow of all the tanks from No. 1 to 10, in table A and from A to H in Table B and probably several others, will meet.

It may be imagined that in so arid a spot as Aden, so many tanks are useless and can never be filled, but I have known many falls of rain during my residence here, which would have filled them all, and many more had they existed.

I regret that I am unable to delay the printing of this memoir, until a plentiful fall of rain, which may be expected about this season, shall have tested their value.

But whether they *all* prove water-tight or no, it is hardly possible to over estimate the value of these reservoirs in a place like Aden, which with a population of 25,000 souls, has a daily supply of sweet water not exceeding 15,000 gallons.

Water containing three parts of saline matter in every 2000 is usually considered unfit for domestic purposes, but in Aden, at least 15,000 of the inhabitants are compelled to drink water containing as much as from five to ten parts in 2000. It cannot therefore be doubted that the large increase to the water supply which these cisterns must afford, will prove an inestimable blessing which would be cheaply purchased at almost any price.

Probably in the most unfavorable season not less than 6,000,000 gallons will be collected, this at once doubles the annual supply, and reckoning the value of this increase at the minimum rate at which water is ever sold in Aden, and at which it has a ready sale, viz., one Rupee per hundred gallons, we have an annual revenue of Rupees 60,000. Thus in a single year, and one far below the average, a greater sum of money will be collected than is likely to be required for the restoration of all the tanks.

I cannot refrain from quoting an extract of a letter addressed to the Right Honorable Lord Elphinstone, under date the 27th of July 1856, by one who saw the tanks on his route to England, and which was communicated to the Political Resident by Government.

"I was much interested in the tanks which Brigadier Coghlan showed me; a short time ago they were as completely buried as Herculaneum, and we passed over some, which being filled up to the brim with rubbish, have less the appearance of being what they are than Pompeii must have had before it was excavated. Six of these have been cleared out and are quite ready to catch any drop of water which falls, they are admirable and substantial works, most beautifully chunamed, and most fantastic in their shapes, with all sorts of queer steps: when they are all cleared out, Aden will be quite independent of exterior sources for its water supply."

Table C is an abstract statement of the receipts and expenditure on account of the restoration of the reservoirs, from the commencement of the work in 1855 to the end of 1856.

The total amount is Rupees 11,543-0-3 of which only Rupees 6,500 has been paid by the State, the balance having been collected from local sources.

A reference to Table A will show that tanks of the aggregate capacity of 3,538,715 imperial gallons have been completed at an expenditure of 11,543 Rupees, in other words, that a permanent and tolerably reliable water supply has been secured to Aden, at the rate of five annas and three pies *of original outlay*, for a constant supply of one hundred imperial gallons *per annum*. The best comment I can offer on this is the fact, that at present, Government is paying to the Haswah water contractor, one Rupee and twelve annas for every hundred gallons of water supplied by him to the vessels of war in the harbour and the various public departments located outside the Main Pass, and the merchant vessels are paying nearly double that price for worse water.

It is much to be regretted that no regular register of the Pluviometer has ever been kept in Aden; but an imperfect series of memoranda exists in the records of the Jail, from which Table D has been framed.

The falls numbered 5 and 8 and the two unrecorded, in September 1853 and March 1854, would have sufficed to fill all the reservoirs in the Peninsula, and those numbered 1,12 and 18 would probably have given not less than 6,000,000 gallons each. Thus in the course of five years the reservoirs would have been entirely filled four times, and about twenty million gallons of water would have been collected in addition at intermediate periods, or calculating the entire contents of the reservoirs, when all shall have been cleaned out and repaired, at twenty million gallons, we may expect to have an annual supply of twenty million gallons, in addition to that afforded by the wells.

This of course may be multiplied indefinitely by constructing new reservoirs at Steamer Point and other localities where they do not at present exist.

The above is of course merely conjectural, the tanks have never been filled, and it is impossible to frame any calculations regarding them, with even approximate accuracy, but I trust that sufficient has been shown, to remove any doubts as to the advisability of carrying on the work, and restoring all that have been discovered, the more so as the expense cannot be very considerable.

TABLE A.

Tabular statement of the Tanks already completed.

Number.	Extreme dimensions, in feet. Length.	Breadth.	Depth.	Capacity in Imperial Gallons.	REMARKS.
1	150	60	40	1,500,000	At the head of Tawela Valley.
2	33	20	28	54,325	On West side of valley, next to, and connected with, No. 1, by an aqueduct.
3	30	34	21	29,875	On West side of valley next to, and connected with, No. 2.
4	45	46	27	188,693	On West side of valley, next to, and connected with, No. 3.
5	74	30	20	93,000	On East side of valley, next to, No. 1.
6	41	26	25	58,000	On East side of valley, next to, and connected with, No. 5.
7	75	30	23	95,987	On East side of valley, next to, and connected with, No. 6.
8½	26	16	9	22,464	On West side of valley, small tank to prevent stones &c, falling into No. 8, connected by an aqueduct with No. 4 and by another crossing the valley with 7.
8	80	70	26	508,940	On West side of valley, connected with No. 8½.
9	39	29	14	52,500	On West side of valley.
10	43	29	17	75,181	Do. connected with No. 9.
11	99	59	28	328,000	Outside gorge of valley on West side.
12	33	18	15	45,000	Outside valley, on the East side, above Parsee cemetry.
13	74	70	33	486,750	A detached tank, on the Munsoorie heights above Church yard.
Total capacity..				3,538,715	

Table B.

Tabular Statement of Tanks, under repair, including all which have been discovered, but not yet excavated.

Designation.	Probable capacity in Imperial Gallons.	Remarks.
A	15,255	Near Bir Khalàd in Tawela valley.
B	54,315	Do. do. do.
C	42,000	Two small tanks joined together, at S E. corner of Tawela valley cleared out, but not repaired.
D	35,000	Next to C.—cleared out but not repaired.
E	22,000	Next to D. Do.
F	32,000	Next to E. Do.
G	600,000	Behind Parsee cemetry, about half cleared out.
H	202,860	Tank in front of I. to catch the stone &c. cleared out, but not repaired.
I	4,000,000	The largest yet discovered, situated just outside of Tawela valley, into which the overflow of all the above tanks, and No. 1 to 10, in Table A. meet;—about half cleared out.
J	1,500,000	Near I. and leading into it, not cleared out, but outline traced.
K	38,250	Small tank to prevent stones falling into J, cleared, out, but not repaired.
L	300,000	Behind Parsee gardens, supposed to be ruined beyond the possibility of repair.
M	Unknown.	Tank in which Parsee garden has been made.
N	Unknown.	Above Jew's burying ground.
O	70,000	Above Sebundee Lines.

TABLE. B. (*continued*)

Designation.	Probable capacity in Imperial Gallons.	Remarks.
P	8,000	Near O.
Q	Unknown.	Large tank, much destroyed, near furnaces.
R	260,000	In good condition, above furnaces.
S	Unknown.	Small tank, quite buried, below R.
T	Unknown.	Large tank, quite buried, below S. will probably contain upwards of one million gallons.
U	340,000	Large tank near R. in good condition, aqueducts destroyed.
V	116,000	In good order, high upon the hill above U. almost inaccessible.
W	190,000	Next U. much destroyed.
X	320,000	Two small tanks below W. much destroyed.
Y	320,300	In corner of hill, near No. 11 of Table A. in good order.
Z	84,000	A large fissure in the rock, walled in, above Q.
a	Unknown.	Above Engineers' store yard.
b	Unknown.	Above lines, 18th Regiment N. I.
c	Unknown.	In lines of 18th Regiment N. I. quite buried.
d	Unknown.	Three tanks above Mess 18th Regimnent N. I.
e	Unknown.	Large tank, in Hydroos valley.
f	Unknown.	Small tank, below Hydroos bund.
g	Unknown.	In the town, near house of Abdulla Mater.
h	Unknown.	Do. near Sebundee lines.
i	10,800	Do. behind town Police station.
z	25,000	At the Hejaff, in good order.
		N. B. Several on Seerah island, not searched for.

TABLE C.

Abstract statement of the receipts and disbursements on account of repairing the ancient Reservoirs at Aden, from the commencement of the work in 1855, till the end of 1856.

Cr.	Rs.	A.	P.	Rs.	A.	P.
1855.						
Realized by sale of water collected in reservoirs.............	40	9	0			
Quit Rent for 1855, collected in this year.....................	501	14	4			
Paid from Municipal Fund......	374	0	2	916	7	6
Estimated value of the labor of 558 convicts at two annas each................	69	12	0	69	12	0
1856.						
Realized by sale of water collected in reservoirs..	692	15	0			
Quit Rent for 1855 collected in this year..................	299	15	8			
Quit Rent for 1856..............	822	1	3			
Government grant in aid of the work........................	6,500	0	0			
Paid by Municipal Fund.......	2,143	12	10	10,458	12	9
Estimated value of labor of 776 convicts at 2 annas each	97	0	0	97	0	0
Total Rupees.				11,542	0	3

Dr.	Rs.	A.	P.	Rs.	A.	P.
1855.						
Labor and material expended during the year...	916	7	6	916	7	6
Estimated cost of the labor of 558 convicts at 2 annas each.	69	12	0	69	12	0
1856.						
Labor and material expended during the year	10,388	12	9			
Compensation paid to the owners of buildings for their removal	70	0	0	10,458	12	9
Estimated cost of the labor of 776 convicts at 2 annas each ..	97	0	0	97	0	0
Total Rupees				11,542	0	3

Table D.

Register kept in the Aden Jail, of the Rain which has fallen between the 12th of December 1851 *and the end of December* 1856.

Number.	Year.	Day.	Month.	Quantity in Inches.	Total during the year.	Remarks.
1	1851	12	December.	1·50		No record previous to this date.
2	1852	3	January.	·50		
3	„	22	„	·25		
4	„	28	„	5·50	6·25	
5	1853	6	December.	·25		A very heavy fall occurred in September 1853, which is not recorded.
6	„	11	„	·50	·75	
7	1854	11	January.	·24		
8	„	12	„	3·72		
9	„	13	„	·04		A fall of about five inches took place in the beginning of March 1854, which is not recorded.
10	„	6	May.	·25		
11	„	25	October.	·17		
12	„	26	„	1·88		
13	„	5	December.	·10		
14	„	7	„	·20		
15	„	28	„	·05	6·65	
16	1855	2	January.	·20		
17	„	9	„	·30		
18	„	10	„	1·30		
19	„	11	„	·24		
20	„	12	„	·10		
21	„	13	February.	·08		
22	„	21	August.	·48	2·70	
23	1856	11	January.	·40		
24	„	22	„	·70		
25	„	23	„	·15		
26	„	11	September.	·13		
27	„	12	„	·08	1·46	

III. *The Tamil Epic Chintamani. By the* Rev. P. Percival.

When the despatch of the Honorable the Court of Directors on their scheme of education was promulgated a year and a half ago, through the vernacular periodical press, its provisions were looked upon by intelligent natives, generally, as a beautiful theory never to be followed by any practical result. It was, indeed, believed, that so much of the despatch as related to English, might, for official purposes, be carried out; but not the most sanguine of my acquaintances among the natives had any belief in that which related to the vernacular languages. Since however a beginning has been made, and measures adopted for realizing the intentions of the Honorable Court, it may easily be conceived how agreeably the friends of education are surprized. The appointment of a Director of Public Instruction, the actual operations of inspection, the Establishment of a Normal School under a competent and zealous Principal, are among the facts serving to assure the native mind that Government is in earnest in the matter of public education. The Director has lately put forth a Code of Instructions for the Head Masters of Talook Schools which has created in many the greatest satisfaction. In that carefully prepared document, it is, in the very first paragraph, stated, that in the Talook Schools the instruction, the matter taught, is to be conveyed through a vernacular medium; when introduced, "English is to be studied only as a language." When the pupil has attained to a fixed standard in the vernacular, he will be permitted to begin the study of English; and not before. These facts are sufficient to show that public instruction is to be largely provided for, and that the vernacular languages will be made the vehicles of useful knowledge to the masses of the population. That the native mind is in any degree aroused by the facts occurring around us is matter of thankfulness. These auspicious prospects are, however, I regret to say, not unattended by much of a discouraging character; the native himself is likely to prove the greatest obstacle in the way of progress as regards vernacular instruction. And I

do not entertain a doubt that, unless Government adopt measures to counteract certain tendencies in the native mind, the machinery it is now forming with so much zeal, ability and expense, will be in great measure inoperative. The native, arguing on palpable facts, maintains that it is not vernacular attainment that confers office and emolument, but a knowledge of English; and consistently enough he is disposed to devote all his energies to the latter. The remedy is, however, in the hands of Government. Let it be promulgated, by Government that in all cases a candidate for public employment from the peon upwards, must pass a graduated examination in order to test his knowledge of his own language; or present a certificate, signed by competent authority, to show that the required standard has been attained: this, and this only, will secure the efficiency of the means adopted by Government, for promoting vernacular education.

It is in place here to refer to a valuable contribution to the study of the vernacular languages of Southern India in the form of a comparative Dravidian Grammar recently published in London by the Revd. Mr. Caldwell. The study of comparative Grammar as regards the Indo-European family of languages has made great progress in the west; and for some time past the Dravidian tongues have been matter of enquiry and investigation among oriental scholars in England and on the continent of Europe. One or two works have issued from the press in Europe in Tamil executed in the most beautiful style. All these facts conspire to persuade the inference that an era is opening for the development of the treasures bequeathed to the natives of Southern India by the talent and industry of former ages.

Under these circumstances it may be of some benefit to direct attention to some of those ancient works which, in Southern India, have, for so many centuries, been the admiration of indigenous scholars; and the patterns for guidance in the authorship of modern times. By thus pioneering the way no doubt needs be entertained as to the track being followed by a succession of adventurers who will do good service. Whilst the attention of Europeans is drawn to the ancient authors of the Dravidian race, and thereby much that

is truly interesting and valuable disseminated in Europe, it must not be overlooked that in the country itself it is of the utmost consequence to the progress of sound scholarship and correct taste that the best authors be brought to light, and if possible, published, under proper editorial supervision and responsibility.

Much, it is admitted, that is found in the indigenous literature even of the best periods, is, like some portions of the works of Greece and Rome, unfit for general perusal. The works of real value should notwithstanding be published and rescued from oblivion. In the course of time they may be expurgated; objectionable sentiments and passages eliminated; thus separated from the vile, the precious would have an enduring value.

These general remarks are intended to introduce to more particular notice the Classical work entitled Chintamani.

It is the opinion of native scholars that the Epic Chintamani, which was composed by Terudèvar sometimes called Tiruttakkadèvar, was written about two thousand years ago; the author was a Jaina and resided at Mylapore, now a suburb of Madras: although this opinion may be incorrect, no doubt the work in question is very ancient; it was doubtless written several centuries ago. This celebrated work is one of the five classical productions which are regarded as undisputed authorities in all matters relating to Tamil philology.

The five works are Chintamani, Chillapadikaram, Valleiyapathi, Kundalakèsi, Manimèkalei.

The book under notice contains the heroic story of a King named Jìvaka; his history is also found in the Maha Purana, a work written in Sanscrit. This Purana belongs to the Jainas, and, of course, is not one of the celebrated eighteen.

The author of Chintamani is regarded by all Tamil Scholars, ancient and modern, as one of the most learned men that ever appeared. It is said that he was acquainted with Agatteyam and Tolkappeyam, the celebrated ancient Tamil Grammars; and that he was deeply read in all the best works then extant in the Sanscrit language, including the Sacred Vedas. The best writers in the Tamil language refer to this work in illustration of their forms of con-

struction, and Grammarians quote this work as of undoubted authority.

Nacchenārkinneār of Madura, himself a man of great erudition, and a commentator on three parts of Tolkappeyam, the Cural, and Sillapadekaram, has also written notes on Chintamani. The comments of this author, on Chintamani and the other works, are regarded by the Tamil Literati as unquestionable authority. The commentary of this writer composed before he had examined the claims of the Jaina theology, was not at first received by that sect. He afterwards, however, revised his commentary, conforming it to their doctrinal peculiarities, and it was thenceforth received by them as a correct exposition of his author.

The Chintamani contains three thousand one hundred and forty-five tetrastichs, and it is divided into thirteen sections called Ilambakam.

1. The story of the hero Jìvaka commences with certain particulars relating to him prior to birth. When an infant, he was cherished by a Chitty, a merchant, who rescued him from the forest in which he was born; his mother having fled thither from the assassin who had slain the King her husband. This section called Namagal Ilambakam contains 408 verses.

2. The second section called Kovindiyar Ilambakam relates the early exploits of young Jìvaka. It appears that a gang of free-booters attacked the city in which he dwelt, plundered it, and carried away much property, driving before them, as they retired, the cattle belonging to the inhabitants. On this occasion the young hero distinguished himself by great bravery, pursued the plunderers, and rescued the spoils they had taken. In consequence of this deed of valour, a citizen named Pasukavalam was induced to give his daughter Kovindeyar in marriage to the son of the Chitty the foster father of Jìvaka. This section contains 84 stanzas.

3. The third section is named Kandarvatatteyar Ilambakam so called from the celebrated musician of the name of Tatteyar whose skill on the Indian lute or vina was almost unrivalled. She formed a resolution not to marry any one who did not surpass her in her

favorite art. Jìvaka entered the list of competitors for the hand of Tattiyār, and his performance on the vìna gained him the prize he coveted. The history of these events contained in this section occupies 358 stanzas.

4. Gundmaleyar Ilambakam is the name of the fourth section which contains 315 stanzas. This section presents to the reader two young women of high family named respectively Gunamalei and Churamanjari who contended for superiority in regard to certain scented powders they possessed. These perfumes were so apparently identic in quality that it was impossible for ordinary persons to determine which was the better. Jìvaka decides the matter in favor of Kunamalei: she accepts him in marriage.

This section further relates some particulars respecting Sudarsanajakshadèva who at that time appeared in the form of a dog, as the result of former deeds. He is metamorphosed by Jìvaka and attains his former position, on account of which he magnifies the powers of his deliverer.

This section also relates the incident of Churámanjari's escape from an Elephant which was killed by Jìvaka when about to attack her.

5. The fifth section is called Pathumeiyar Ilambakam. This section narrates the travels of Jìvaka in foreign lands. In the course of travel he meets Pathumei, a daughter of the king of Pallavam, when she was engaged in gathering flowers; as she was thus employed she was bitten by a venomous serpent: she is healed by Jìvaka, and in gratitude gives him her hand in marriage. The section contains 246 verses.

6. The sixth section is called Kemasariyar Ilambakam. This portion of the work narrates the visit of Jìvaka to Kshèmadèsam where he performs prodigies that gain for him the admiration of the king who bestowed on him his daughter in marriage: her name was Kshema Sundári. This section contains 145 verses.

7. The seventh section is called Kanakamaleyar Ilambakam. Here Jìvaka the hero of the poem is found in Susanadèsam.

The king suspends on high a mark, promising to give his daughter

in marriage to the person who might succeed in displacing it by an arrow. Numerous royal personages compete for the coveted prize which was obtained by Jìvaka.

This section also relates the success of Jìvaka in obtaining in marriage for his foster father's son the daughter of the king of Saba, her name was Chisanti. This section contains 330 stanzas.

8. The eighth section is called Kimaleiyar Ilambakam, and contains 107 stanzas, Jìvaka taking his departure from Susanadèsam proceeds to Nannadu where he meets his mother in Tandakaraneyam, and salutes her. Having returned to his own city, he connects himself with a merchant, who, in consequence of the prosperity he enjoyed, and which he attributed to the auspices of Jìvaka, gives him his daughter in marriage ; her name was Vimalei.

9. This, the ninth section, containing 108 stanzas, relates the marriage of Jìvaka with Suramanjari, who, on the occasion of the dispute about the perfume, made a vow never to marry any other person.

10. The tenth section is called Manamagal Ilambakam. This section narrates the success of Jìvaka in competing for the hand of the daughter of his maternal uncle the king of Vidèkam. The king suspended a target, proclaiming that the prince who succeeded in hitting it should have his youngest daughter. Jìvaka is the successful party among many competitors and receives in marriage the fair damsel. The assassin and late minister of Jìvaka's father, who then reigned over the kingdom he had so unfairly obtained, hearing of the fame of the young man, suspects that he may prove to be the son of the deceased king. He therefore determines to seize him and put him to death ; and for this purpose proceeds to take him by violence. Jìvaka meets him, slays him, and ascends the throne of his ancestors. There are 358 stanzas in this section.

11. The eleventh section is named Purmagal Ilambakam and contains 51 stanzas. This section relates to the conquest by Jìvaka of the dominions of his father's assassin. This country was called 'Emangadèsam.

12. The twelfth section is called Ilakaneiyar Ilambakam and

contains 221 verses. In this portion of the work the nuptials of Jìvaka and Ilakanei his maternal uncle's daughter are described.

13. The thirteenth section is called Mutti Ilambakam. The final portion of the poem describes the religious acts of Jìvaka and his wives, the partition of his dominions among his sons, and the renunciation of all secular pursuits and objects by himself and his devoted female associates.

This brief analysis of the work under notice, it is confessed, conveys but little to persuade the conviction of its superiority; the assumed facts of the Epic alone are here given. Though these may appear inadequate as the basis of a work for which so much is claimed, yet the work itself is so replete with credible incidents, so wrought up by the vigor of literary talent, so interspersed with remarks involving the keenest intropection into the grounds of human action, so rich in theological sentiment, so redolent of all the attractions of poetic genius, so full of circumstances evincing the condition of the arts and the customs of social life at the period of its composition; that the scholar, the poet, and the antiquary must be equally impressed in favor of the talent of the author, and the unrivalled power of the language in which he has embodied the splendid creations of his imagination.

Sometime ago an intimation was put forth in one of the weekly Journals to the effect that the work, whose analysis is here briefly sketched, would, if encouragement were afforded, be published. The idea has not been abandoned; but such would be the weight of the undertaking to a single individual, it can hardly be expected that any one will be bold enough to enter upon it. No doubt a considerable number of copies might be sold among the natives perhaps 500, and in time, it is possible, the publisher might recover the capital expended on the work.

IV *Entomological Papers, being descriptions of new Ceylon Coleoptera with such observations on their habits, ect., as appear in any way interesting. By* JOHN NIETNER, *Colombo Ceylon.*

No. IV.

Trib. BEMBIDIIDÆ.

Ochthephilus. n. g. N.

Corpus oblongum, subparallelum, valde depressum. Caput magnum antice trigonum ; oculis magnis, ovatis, prominulis ; collo forti. Mentum subquadrate emarginatum, lobis extus fortiter rotundatis, apice abrupte acuminatis, dente parvo acuminato. Ligula parva apice quadrate truncata, libera, paraglossis setiformibus marginem anteriorem longe superantibus. Palpi robusti art. 4° elongato, tenui, acuminato ; maxillares art. 3° interne—, 2° externe incrassato ; labiales art. 3° robusto externe incrassato, 2° parvo, cylindrico. Labrum parvum subtrigonum, antice emarginatum. Mandibulæ elongatæ, rectæ, trigonæ, apice arcuatæ, infra medium pluries dentatæ. Antennæ robustæ corporis med. fere attingentes, art. 1° et 11° mediocribus, subæqualibus, 2-4 et 5-10 inter se subæqualibus illis subcylindricis, his ovatis, Thorax subcordatus basi quadratus. Pedunculus brevis. Elytra apice rotundata. Pedes omnes simplices, subæquales, anteriores tibiis profunde excavatis, tarsis leviter contractis, art. 1-4 gradatim minoribus, art. 1° subcylindrico 2-4 subtrigonis, 5° sat magno, unguibus simplicibus.

43 *Ochthephilus Ceylanicus N.*

O. brunneo-testaceus, pedibus palpisque testaceis tenuiter pubescens ; fronte profunde 2-sulcata ; elytris obsolete striatis, in striis punctatis ; long. corp. 1⅓ lin.

In fluminum ripis *Bembidiorum* more victitat.

This interesting little beetle might at first sight be mistaken for a *Læmophlæus*, the size, depressed form and color of which it has,

however, the prominent eyes, cordate thorax— to say nothing of its habitat—remind one very soon of its real connexions. I do not think there can be any doubt that this insect forms a new and interesting addition to the BEMBIDIIDÆ. In fact the question, whether it belongs to this tribe or not depends, in my opinion, mainly upon the inferences drawn from the structure of the terminal joint of the palpi. It is true that this joint attains in *Ochthephilus* a degree of development unequalled amongst the BEMBIDIIDÆ; as, however, this development is not confined to the one particular joint alluded to, but affects the entire organ of which it forms a part, it can hardly be said to be a variation of much importance; and as, moreover, the general shape (independently of the elongation) and mode of insertion are the same as in the typical BEMBIDIIDÆ I have not hesitated to refer my n. g. to this tribe.

The head is as broad as the thorax and altogether of about the same size, it is strongly triangular from the eyes to the tip of the mandibles, the forehead is impressed with 2 deep longitudinal furrows, the eyes are large, rather oval and prominent, behind them the head is abruptly contracted into a thick neck. The antennæ are long and thick reaching nearly to the middle of the body, joints 1 and 11, 2 4 5-10 are subequal amongst themselves, 5-11 oval, 1-4 subcylindric. The labrum is small, rather triangular being narrowed at its base, it is emarginated in front with a slight angle in the middle emargination. The mandibles are long, straight triangular, bent at the tip only, dentated below the middle the one more so than the other. The maxillæ are thin and slender gently bent outwards at the base and inwards at the apex the outer lobe corresponding with the inner one in shape and strength. The palpi are robust, both the maxillary and labial ones have joint 4 elongated, thin and acuminated, in fact needle-shaped, firmly implanted in the preceding one not loosely hinged to it. The maxillary ones have joints 3 and 2 robust, the former swollen on the inner, the latter on the outer side. In the labial ones, joint 3 is still plumper than in the others, but differs in shape by being incrassated on the outer instead of the inner side, the 2nd joint being at the same time quite small and cylindric. The mentum is large

and simple as above described. The ligula is small, oblong, very slightly narrowed and transversely cut away at the apex, the paraglossæ separate from its sides a little below the anterior corners; they are setiform and reach much beyond it. The whole organ is of membranaceous texture having, however, a more substantial centre or back. The thorax and elytra are simple and sufficiently described above. I may add that the former is divided by a longitudinal furrow and that both are furnished with a narrow margin at the sides. The scutellum is very small and the abdomen furnished with a short peduncle. The legs are weak, simple and nearly equal, the anterior tibiæ are deeply notched, the lower margin of the fourth tarsal joint of the same pair is furnished with a long thin spine, the apex of which fits in between the claws. I have been unable to discover any footbrushes or other sexual distinctions in the specimens before me, but it is not improbable that the tarsal spine just mentioned occurs only in one sex.

The habits of the insect are those of the *Bembidia* in whose society it lives upon the banks of rivers, taking like them readily to its wings. I have found it occasionally in considerable numbers upon the sandy banks of the Maha Oya in the neighbourhood of Negombo close to the edge of the water.

Trib. LEBIIDŒ *vel* PERICALIDŒ.

Creagris. n. g. N.

Corpus oblongum valde depressum. Caput magnum robustum; oculis mediocribus, ovatis, sat prominulis; collo brevi. Mentum forma ferri equini vel trifurcatum (hinc n. g. *Creagris*) lobis angustis, subparallelis, apice oblique truncatis, dente lobis parum breviore, tenui, acutissimo. Ligula magna, cornea, angulis anticis rotundatis, paraglossis connatis, marginem anteriorem non attingentibus. Palpi maxill. art. 4° claviformi, apice fortiter truncato; labiales art. 4 subelliptico, truncato. Labrum maximum, suborbiculatum, convexum. Mandibulæ parvæ, basi obsolete unidentatæ, labro obtectæ. Antennæ robustæ humeros attingentes, art. 1, 3 et 11 longitudine fere subæquali, mediocribus, 2° parvo, rotundato, 4-10 subæqualibus, cum 11° ovatis. Thorax parvus capite sesqui minor, transversus longitudine duplo fere latior,

infra med. fortius angustatus, basi parum prolongatus. Pedunculus brevis. Elytra apicem versus leviter dilatata, apice fortiter subquadrate truncata. Pedes robusti, simplices, subæquales, ant. tibiis profunde excavatis, omnes tarsis brevibus art. 1° sequentium 2 fere longitudine, subcylindrico, 2 3 gradatim minoribus, magis minusve triangularibus, 4° magna, profunde bilobo, 5° mediocri, unguibus simplicibus, art. 4° subtus dense penicillato.

44. *Creagris labrosa N.*

C. picea, ore antennisque, coxis, trochanteribus femorum tibiarumque apice et tarsis brunneis; dense punctata obsoleteque pubescens; elytris striatis; long. corp. 4½ lin.

Specimen singulum prope Colombo nocte ad lumen cepi.

I consider this scarce and interesting insect to form a passage between the LEBIIDÆ and PERICALIDÆ, but am doubtful to which of these two tribes to refer it as, although it partakes of the characteristics of either, it is at the same time distinct from both. Distinguished in several respects, its most extraordinary character lies in the curious shape of the mentum. This is, however, easily described as large, of the shape of a *horseshoe* with a long, thin, very pointed tooth in the middle, the apical half of the sides (lobes) being at the same time gently dilated, the apex itself being obliquely cut away from the outer towards the inner side (the inner angle being the most advanced) and slightly dentated at the edge thus formed. Or it may also be described as *a fork* with the outer teeth somewhat enlarged, truncated at the apex and so forth. As far as I know, this variation from the usual form of the mentum is repeated in no other *Carabideous* insect. The other parts of the mouth have not much to distinguish them with the exception, however of the labrum which attains a very extraordinary degree of development occupying *rather more than one-third of the whole head, although the latter itself is large and heavy.* It is of a suborbicular shape, very slightly produced in front into an obtuse angle, is vaulted, covers the mandibles, has two longitudinal impressions at the sides of the base and is highly polished. The head has two impressions in front of the eyes, is densely punctured and thinly pubescent, it is strongly but gradually contracted behind the eyes

and formed into a short neck. The antennæ are strong, and reach to the shoulders, joints 1 3 and 11 are of about equal length, middling, the former two subcylindric, joint 2 is small, rounded, 4-10 subequal and with the 11th oval. The thorax is small, only half as large as the head, rather narrowed, strongly transverse, twice as broad as long, slightly emarginated in front, the anterior angles rounded, contracted below the middle, subquadratic and prolonged at the base, posterior angles depressed, longitudinally divided by a deep furrow. The elytra are striated and, as well as the thorax, densely punctured and thinly pubescent. The legs are strong, simple and subequal, the anterior tibiæ are deeply notched, the first joint of the tarsi is as long as the two succeeding ones together, subcylindric, the 2nd triangular, the 3rd of a similar but more transverse form, smaller—all three have the apical angles acuminated, the 4th is large and deeply bilobed, the 5th middling, thin, the claws simple. The tarsi are altogether short and strong, the first joint is furnished with longer, the 2nd and 3rd with shorter stiff hair, whilst the 4th is strongly penicillated below. The anterior tibiæ are slightly spinose, the others more so.

I believe the only specimen of this insect which has hitherto come into my possession, and which has served as the type for the above description, to be a female.

Trib. GALERITIDÆ.

Heteroglossa. n. g. N.

Corpus oblongum, subparallelum, depressum tenuiter hirsutum. Caput mediocre oculis semiglobosis, sat prominulis; collo brevi. Mentum sat profunde subquadrate emarginatum, lobis magnis extus fortiter rotundatis, apice abrupte acuminatis, dente magno excavato, apice inflecto obtuso, magis minusve profunde sinuato. Ligula subcornea apice libera, truncata, vel quadrata vel obconica vel leviter bi-sinuata, paraglossis cylindricis, marginem anteriorem longissime superantibus, magis minusve arcuatis. Palpi hirsuti, art. ultimo sat elongato, subcylindrico, apice truncato vel subtrigono. Labrum transversum antice emarginatum. Mandibulæ validæ, trigonæ, apice arcuatæ, basi pluries dentatæ. Antennæ robustæ, corporis med. attingentes, art. 1° incrassato se-

quentibus 2 longiore, 2° parvo, 3-11 subæqualibus. Thorax subcordatus, basi transversim truncatus leviterque prolongatus. Pedunculus brevis. Elytra apice fortiter subquadrate truncata, costata, costis 16 majoribus, in interstitiis subtilissime bicostulata, in sulcis (sulco e tribus inter costas binas majores medio excepto) tenuiter pilosa, in omnibus transversim regulosa. Pedes anteriores tibiis sat fortiter emarginatis, tarsis maris art. 1-3 leviter dilatatis, subtus squamularum seriebus 2 munitis, art. 1 elongato-trigono, 2-3 rotundato-trigonis, 3° præcedente parum minore, 4° parvo cordato 3° plus sesqui minore, his omnibus angulis acuminatis, 5° magno, unguibus simplicibus.

This diagnosis may appear somewhat vague, still I have been unable to express the characteristics of the insects from which it is drawn in more precise terms, although they have features quite peculiar to themselves by which they are easily recognised when once seen.

The points on which the three spec. which form this g. more or less disagree are the following : 1, the labrum : this is more transverse in *H. elegans* and less deeply emarginated in *H. ruficollis* than in the other two spec. respectively—still in all three it is *emarginated* and has moreover the peculiarity of being furnished with bristles at the two anterior corners : 2, the mentum : this is subquadratically emarginated, the lobes being strongly rounded on the outer side, and abruptly acuminated at the apex, at the base of the emargination it is furnished with a broad, excavated tooth which is inflected and obtuse at the apex—so far all three species agree—however, whilst in *H. elegans* and *ruficollis* this tooth is slightly emarginated, at the apex, it is sharply notched in *H. bimaculata*, in fact bilobed, the lobes being large and rounded at the apex. I look upon this notch, which is sharp but not deep, as a mere variation from the emargination existing at the apex of the tooth of the former two species. 3, the palpi : these, labial as well as maxillary ones, have their terminal joint truncated at the apex—and so far again all three species agree—however, whilst this joint is of elliptic form in the palpi of *H. ruficollis*, it is in *H. elegans* only so in the labial ones that of the maxillary ones being cylindric at the base.

In *H. bimaculata* finally, this joint is rather clubshaped or subtriangular and stronger truncated than in the former two species. 4, the ligula: this organ is of subcoriaceous texture, middling size, the shape of an oblong square, free and transversely truncated at the apex—these characters are common to all three spec. and in *H. ruficollis* I have nothing to add to it, however, the anterior margin, which is straight in this species, is slightly bisinuated in *H. elegans* the outer angles being acute and the central one obtuse. The ligula of *H. bimaculata* differs from both the former in as far as it is narrowed towards the apex and depressed towards the sides and the front, the anterior margin is otherwise cut away straight, without any sinuosities, but it is rather strongly armed with bristles. The paraglossæ agree in all three spec. in as far as they are highly developed, reach much beyond the anterior margin of the ligula and are more or less bent inwards. They assume their greatest development in *H. elegans* in which they nearly touch each other in front of the anterior margin, being cylindric and slender at the same time. In *H. ruficollis* the paraglossæ are somewhat shorter and straighter and in *H. bimaculata* still more so.

On all other points the three spec. perfectly agree; in saying which I lay particular weight upon the unusual sculpture of the elytra and the rather peculiar hairy vesture of the insects, bearing also in mind their general appearance, proportions, system of coloration, mode of living, etc. As to the hairy vesture of certain parts of the body and the sculpture of the elytra, it is true that these are not generally looked upon as of much importance, however, they appear to me to be so in this instance, as they present certain unusual variations repeated in all three species. The hairy vesture consists in thin yellowish or reddish hairs thinly sprinkled over the back and still more thinly over the whole of the lower surface of the insects, being at the same time longer at the latter place. This vesture acquires its greatest density on the legs, especially the tibiæ and tarsi, whilst their uniform presence at the palpi forms almost a generic character. The elytra are exquisitely sculptured into about 8 larger costæ on either of them and into 2 smaller ones between every 2 of these, the furrows thus formed are finely and transversely rugose and (with

the exception of the central furrow between every 2 larger costæ) thinly pubescent.

It just strikes me that this sculpture of the elytra may occur in other Galeritidæ. If so, the insufficiency of my means to ascertain this fact with certainty, must plead my excuse for attaching undue importance to it. However, I should in this event, consider my books of reference, none of which say anything to that effect, greatly (and indeed more than myself) in fault, for not alluding to it, as in my opinion it is sufficiently peculiar to be mentioned.

After this lengthy preamble I shall have but a few words to say in finishing the description of the species.

45. *Heteroglossa elegans. N.*

H. supra rufo-castanea, capite obscuriore, maculis 2 humeralibus obsoletissimis ferrugineis; subtus dilutior, pedibus antennis oreque subtestaceis, elytris ad angulos apical. extern. testaceis; long. corp, 3½ lin.

In lacus Colombensis ripis, sub vegetab. putrescent. non infrequenter cepi.

An agile, pretty little insect of chocolate color, and with the general features of the family. Head smooth, polished, above and below slightly punctured, with 2 impressions in front of the eyes, anterior angles of labrum rather acuminated. Thorax deeper and more densely punctured than the head and with the elytra thinly hirsute, rather strongly emarginated in front, less so behind; sides, especially at the basal angles, depressed, divided longitudinally by a deep furrow. Scutellum, like thorax punctured and hairy. Elytra with the inner apical angle right and the outer rounded off, largely punctured within the margin especially near the apex. Tibiæ with a row of larger spines down the outer and a row of smaller ones down the inner side, 4-calcarate at the apex, the 2 inner spurs larger.

46. *Heteroglossa ruficollis. N.*

H. colore præcedentis sed obscurior, thorace pectoreque rufo-testaceis, antennis art. 3 primis nigrescentibus; long. corp. 4½ lin.

Cum præcedente sed rarius et per occasionem nocte ad lumen cepi.

The shape of the body is quite that of the former but the insect is larger. The head is less distinctly punctured than in the former and there is an additional impression in the middle of the forehead. The thorax is also less deeply punctured, but the divisional furrow is more so than in the preceding species. The anterior tibiæ appear somewhat less deeply notched. There is nothing else to add to the description that has not been pointed out already.

47. *Heteroglossa bimaculata. N.*

H. subcastanea, thorace capiteque rufo-testaceis, elytris medio maculis 2 flavis pictis, pedibus abdominisque apice testaceis ; long. corp. 5½ lin.

Ubi præcedentes infrequentissime legi.

Head, with the exception of the forehead, deeply punctured, with 2 impressions in front of the eyes, anterior angles of labrum rounded. Thorax densely and deeply punctured, with elytra thinly pubescent. The latter with a round yellow spot at the middle of each.

48. *Chlænius princeps. N.*

C. aureo-viridis, scutello cupreo, elytris nigro-viridibus ad basin et infra marginem viridibus, sutura nigra, subtus piceus, coxis trochanteribusque 4 ant. dilutioribus, femoribus trochanteribusque 2 post. testaceis, tibiis tarsisque obscurioribus, ore antennisque brunneis, labro, mandibulis limboque castaneis; capite obsolete ruguloso, punctulato ; antennis art. 3° quarti prope longitudine ; menti dente forti laciniis apice rotundatis ; thorace ovato-quadrato, latitudine parum longiore, angulis ant. subrectis, post. rotundatis, basi fortiter 2-impresso, punctato ; scutello canaliculato ; elytris striatis, in striis punctatis, ad strias, præsertim apicem versus, tenuiter pilosis ; long. corp. 8 lin., lat. 3 lin.

Specimen singulum f. prope Colombo sub-lapidibus cepi.

A very handsome species, distinguished by its size and comparatively great breath. The clypeus is impressed with 2 setigerous pits near the ant. corners. The labrum is transverse, slightly sinu

ated in front, narrowed at the base and has the ant. angles strongly rounded off. The last joint of both the maxillary and labial palpi is cylindric and truncated at the apex, in the maxill. it is shorter than in the labial ones, in the latter somewhat narrowed at the base and slightly inflated at the middle, both appear slightly compressed at the apex. The elytra are strongly rounded at the apex. The insect has a very strong smell, somewhat like musk, about it.

49. *Chlœnius maleolens. N.*

C. capite. thorace scutelloque obscure cupreo-viridi-glaucescentibus. elytris obscurioribus, pubescentibus, maculis 2 subapicalibus flavis ornatis, subtus piceus, pedibus testaceis, ore antennisque brunneis, mandibulis limboque castaneis; capite ad clypei marginem post. profundis 2-foveolato punctulato, occipite leviter transversim ruguloso ; antennis art 3° quarto subæquali vel paulo breviore ; menti dente apice leviter sinuato ; thorace subquadrato, lateribus leviter rotundatis, profundius punctulato atque levissime transversim rugoloso, ad basin 2-impresso, parce piloso ; elytris densius pubescentibus, striatis, in interstitiis 3-8 utrinque ante apicem macula suborbiculari flava ornatis ; long. corp. 6¼ lin.

Specimen singulum m. prope Colombo cepi.

Also a handsome and rare species, smelling strongly and disagreeably of creosote. Head thorax and scutellum are of a dull bluish green color with copper reflexions on the back, the elytra are of a blackish green, pubescent and adorned with 2 yellow spots between the middle and apex, this is of an irregular, rounded outline and stretches from the middle of the 3rd interstice across to the 8 stria. The 4th joint of the maxill palpi is subcylindric, that of the labial ones larger, plump and rather triangular. Tooth of the mentum not bifid but truncated and merely slightly sinuated at the apex. The elytra are narrowed at the apex.

50. *Harpalus (Ophonus) senilis, N.*

H. oblongo-ovatus, subdepressus, punctato-rugosus, griseo-pubescens, supra æneus, subtus piceus, ore pectoreque dilutioribus, pedibus testaceis, antennis basi palpisque apice flavis ; capite robusto antice rotundato, postice parum angustato, thorace vix angustiore ;

antennis humeros attingentibus art. 2_o parvo, reliquis longitudine subæquali; mandibulis obconicis robustis, una unidentata, altera incisa; labro vix emarginato; palpis art. 4° ovato, apice abruptius angustato, leviter truncato; thorace transverso, longitudine tertia parte latiore, elytris vix angustiore, lateribus rotundato, infra med. leviter angustato, basi subquadrato, hic vix, antice leviter emarginato, angulis apicalibus obtuse acuminatis, basalibus subrecte rotundatis; elytris punctato-striatis, apice fortius 2-sinuatis et angustatis; tarsis art. 4° cordato; long. corp. $4\frac{1}{2}$ lin. lat. $1\frac{1}{2}$. lin.

Prope Colombo sat copiosus.

This as well as the succeeding two species fly very commonly into rooms at night during the rainy weather. The present spec. is a fine, comparatively large, robust insect. I may add to the above description that the emargination of the mentum is of middling size, its lobes rounded externally and its tooth just marked in the shape of a slight obtuse rising at the bottom of the emargination. The ligula is very small and narrow, the paraglossæ very large adhering to it and enveloping it fully and on all sides, the whole is very slightly cut away at the apical angles and slightly, but abruptly and rather deeply, notched at the centre of the anterior margin. I may further notice that some of the individuals before me have the apex of the maxill. palpi prolonged, cylindric and slightly bent inwards; as this is not a sexual distinction and as the insects thus distinguished differ in no other respect from the rest, I look upon them as curious varieties.

51. *Harpalus (Ophonus) rugosus N.*

H. præcedenti simillimus sed sesqui minor, magis rugosus, antennis robustioribus art. 5-11 ovatis leviter depressis, colore supra parum obscuriore, subtus dilutiore, pedibus albidis, coxis tarsisque brunneis, antennis totis castaneis; long. corp. $3\frac{1}{2}$ lin.

The small size and, upon close inspection, the other peculiarities just pointed out, readily distinguish this species from the former in spite of their close affinity in other respects. They are both equally common about Colombo.

52. *Harpalus (Selenophorus) Colombensis. N.*

H. statura præcedentis sed gracilior, glaber, supra læte æneus, subtus subcastaneus, pedibus albidis, coxis, tarsis, antennis palpisque testaceis, ore brunneo; capite transversim ruguloso; antennis præcedente tenuioribus, palpis gracilioribus apice magis angustatis; labro basin versus leviter dilatato; mandibulis infra apicem abruptius arcuatæ, una uni— altera bi-dentata; thorace lateribus præcedente minus rotundato, basi minus angustato, hic rugoso-punctato, antice leviter longitudinaliter strigoso; elytris striatis, parce punctulatis, in interstitis 3°, 5° et 7° punctis majoribus impressis; long. corp. 3 lin.

Prope Colombo sat copiosus.

A pretty little insect, very distinct from the preceding two. I may add that it also differs somewhat in the paraglossæ, the anterior angles of which are distinct.

Trib. HARPALIDŒ?

Compsolepis. n. g. N.

Corpus oblongum, robustum, subconvexum. Caput ovatum, mediocre; oculis semiglobosis prominulis. Mentum leviter subsemilunariter emarginatum, lobis extus rotundatis, dente vel parvo, obtuso vel nullo. Ligula mediocris, cornea, oblonge quadrata, apice transversim truncata, libera, paraglossis cylindricis apice truncatis, sat robustis, marginem ant. parum superantibus. Palpi articulo ultimo elliptico, truncato. Labrum apicem versus angustatum, apice rotundatum. Mandibulæ validæ, apice arcuatæ, una uni—altera bi-dentata. Antennæ filiformes, humeros parum superantibus, art 2° parvo, reliquis longitudine subæquali. Thorax mediocris longitudine parum latior, antice vix, postice haud emarginatus, lateribus leviter rotundatus, basi parum angustatus, angulis omnibus rotundatis, margine elevato. Elytra ovata, infra med. parum dilatata, apice leviter angustata et acuminata. Pedes subæquales, tibiis apice bicalcaratis, calcaribus intus subtiliter serratis, ant. leviter emarginatis, tarsis 2 ant. art. 1-3 leviter dilatatis gradatim minoribus, art. 1° cylindrico, 2° obcordato, 3° trigono, omnes art. 4° *maris* bilobo, *feminæ* bifido, art. 5° magno, unguibus validis, simplicibus,

subtus tarsis 2 ant. art. 1-4, intermed art. 2°-4° squamularum longepedunculatarum seriebus duabus munitis.

53. *Compsolepis foliolosa. N.*

L. glabra, supra obscure brunnea, thoracis elytrorumque limbo testaceo, subtus brunneo-testacea; pedibus albidis; antennis art. 3 primis flavis, reliquis nigrescentibus; palpis art. ultimo testaceo, reliquis flavis; thorace ad angulos basales profundius foveolato; elytris striatis; prosterno canaliculato; long. corp. 3-4 lin.

Specimina nonnulla mens. Octob. prope Colombo nocte ad lumen cepi.

The internal vesture of the tarsi of these otherwise inconspicuous insects, constitutes their most important character and is altogether of a very interesting nature. I proceed at once to describe it at full length, premising that *I believe* I have both the male and female before me. The individual which I take to be the male is smaller and of a darker color than the other. The legs, with the exception of the tarsi, are the same in both sexes. They are of middling strength, the tibiæ are furnished with 2 spurs at the inner side of the apex, which spurs are finely serrated along their inner edge, the tarsi have joints 1-3 of the first pair slightly dilated, the posterior pair is elongated, subcylindric and the intermediate one forms a passage between the two. Joints 1-3 of the first pair decrease gradually in size, joint 1 being at the same time subcylindric, joint 2 rather cordiform and joint 3 rather triangular, joint 4 in all the six tarsi is bilobed in the male and bifid in the female, this character being, however, less distinctly expressed in the 2 post. tarsi than in the 4 ant. ones; joint 5 is large and the claws strong and simple, a membranaceous process of triangular form covers the base of the latter above.

The internal vesture of the 4 ant. tarsi of the *male* is of the following description. The inner part of joints 1-4 of the 2 ant. ones is furnished with 2 longitudinal series of peduncled squamulæ which are of a broad, triangular form and lie like tiles upon each other covering the sole of the tarsus, they are flanked by bristles which partake of the nature of the scales being dilated in the shape of a lancet. These squamulæ are without any particular color, they

are unconnected amongst themselves, their edges are entire and and they attain their highest development at the apex of the 4th joint, in fact their development is gradual from the base of the 1st joint to the apex of the 4th. The intermediate tarsi, although not dilated, are similarly provided as the anter. ones, but only at the apex of the 2nd and at the 3rd and 4th joint, the squamulæ being of rather a square shape, triangularly prolonged and peduncled at the base; the 1st joint is naked in this pair.

The tarsi of the *female* are very much the same as those of the male, excepting the 4th joint which, as above mentioned, is bifid. A further distinction exists, however, in the squamulæ. In the 2 ant. tarsi of the female these are present at the apex only of the 1st and 2nd joint (hardly distinct at the former); however, they are well developed in the 3rd and very highly in the 4th joint, the squamulaceous bristles are less conspicuous but the peduncle attains extraordinary length in the 4th joint, the squamulæ do not cover each other like tiles but stand more freely and loosely and are curved inward so as nearly to touch in the middle, their shape is that of an elongated triangle, they are veined and their apical edge is serrated. Being such and placed upon long, slender, peduncles they forcibly remind me of the leaflets of certain ferns (Adiantum) and hence the specific name *foliolosa*. The intermediate tarsi are similarly provided, but, as in the male, the 1st joint is naked and the 2nd furnished at the apex only. The lower edges of the 2 posterior tarsi are very neatly fenced in with small closely set spines.

I feel doubtful as to the affinities of these insects, especially if in reality I have described both sexes and if the vesture of the intermediate tarsi is allowed to be of the same importance as that of the anterior ones, however, I think they must find a place amongst the HARPALIDÆ as restricted by Lacordaire. I must not omit to mention that the tooth of the mentum appears to be variable, one of my specimens (a male) being decidedly without it, whilst another is furnished with a small, obtuse one.

V. *Observations on Provincial Exhibitions and the improvement of the Resources of the several Districts of the Madras Presidency.* *By* J. FORBES ROYLE, M. D.

1. The correspondence referring to the establishment of Provincial Agricultural Meetings for the distribution of Prizes in the several Collectorates of the Madras Presidency, is pregnant with important facts and inferences for the future improvement and development of the Resources of these Provinces. Considering the general state of information among the class of cultivators, not only in India, but in other parts of the world, it is not surprising, that the first enunciation of a proposal, in which money and jewels were to be given and nothing received in return, was received in some places with suspicion, and others with indifference, and in most with unwillingness to exhibit. All this is justly ascribed to the novelty of the proposed scheme and to the ignorance of the great mass of the people; where it is said, "The person most "respected among the Hindoo population, is the man who does as "his ancestors have done; and who, on all occasions upholds the "*mamool* or custom. The person looked upon with suspicion, is "the man who troubles the village with change and novelty." Coll. page 157.

2. Though the success of Exhibitions in this country is appealed to, and spoken of as a thing not to be expected in the East, I am far from participating in the sentiment. For I happen to be one of those who practically experienced the difficulty of inducing those who were the most able, to be the most ready to contribute to the Great Exhibition of 1851. Having been entrusted by the Royal Commissioners with the Department of Raw Products, my principal business at first was to induce parties dealing in different classes of Raw Products to contribute collections of specimens of the Articles in which they dealt, in order that the Great Exhibition

of 1851, as it was wished that this being the first of the kind, should contain a complete collection of all the Raw products, which were known as Articles of Commerce. In representing the objects contemplated and requesting different parties to contribute, so far from alacrity, I found, with certainly some striking exceptions, disinclination in many to whom I applied, to contribute. They alleged that it was useless to exhibit things that were so common and known to all the world, and which each and all in the same business might contribute equally well. Difficulties were, however, overcome, and will be so elsewhere with perseverance, especially as it is proposed to continue the Madras Exhibitions for two or three years. It seems desirable as suggested by some Collectors, that facilities should be afforded for sale and barter. The success of European Exhibitions would be very limited, if it were not for the opportunity afforded to manufacturers of making known and selling, or taking orders for the sale of goods.

3. Though local officers are the best judges of the times at which the proposed distribution of prizes should take place, as well as of most of the things which require to be encouraged in their own districts, yet there are other points which can be as well, if not better settled, by those at a distance who have paid attention to such subjects or have watched their working in foreign markets.

4. The first point deserving consideration is, whether the productions of a district are intended for home consumption, or for export to foreign markets. In the first case, the people of the district are themselves the best judges of what they require, and what they wish to have improved, or what to have introduced as new cultures among themselves. In the second case, the purchasers in foreign markets, or their agents and brokers, are the best judges of what are the defects of any known product; or what are the kinds of substances which are most likely to meet with purchasers, when first introduced into their markets. But there are few important cultures which may not be noticed under both heads, and to which therefore the same general observations may apply. Thus there are few Indian products, or rather few products sent to market by

the natives themselves, which may not be greatly improved in the state of *cleanness* or of *preparation* in which they are sent to market.

5. In the Ganjam district the Collector says, the people are not only "very bad cultivators," but they will not take the trouble to clean and separate the good and bad seeds, nor learn that good rice is often rendered of much less value, from the intermixture of even a small quantity of inferior dark coloured grain. This was in vain urged on the Ryots of Polaky, by Mr. Linares, a merchant of Calingapatam, Coll. p. 27. But even in the district of Canara, where the inhabitants are said to be "generally alive to their own inter-"ests," and where "some departments of Agriculture are carried "to a high pitch of perfection," "the methods of preparing the articles for the market are often exceedingly defective," Coll. p. 154. But nothing can be worse than the practice alluded to by the Collector of the same district, and said to be almost peculiar to India "that is the system of *Nerick* or fixed price. A candy of "tobacco for instance is brought down to a low price by means of "adulteration; the dealers have no resource, but to adulterate all "the tobacco down to that value. For it is not the custom of the "country to say, bring it me unadulterated and I will pay you a "higher price. This is never done," Coll. p. 160. So the cotton of India never realizes the price which it would command, if sent in a clean and unadulterated state; for the consumers being accustomed to meet with a certain proportion of dirt, reduce the price at which they purchase, so as always to cover their loss, this in addition to the shortness of the staple, assists in keeping Indian cotton at a low price; so likewise the want of due preparation prevents some Indian fibres, otherwise of good quality from attaining their full value.

6. Though this subject is not alluded to by all the Collectors, it is one of the greatest importance; for if the cultivators of India could be convinced of the benefit which would ultimately result to themselves, a great good would be effected. For the higher prices which Indian products would then command in European markets, would enable local purchasers to give a better price than they now can, to the actual producers of the goods. Prizes might therefore

be well given for ordinary products carefully harvested, or well cleaned and prepared for market, especially when such are also articles of export. It is probable that local merchants would at once give a better price for an improved article, though it might be some time perhaps, before they were able to do away with the prejudice against Indian products, because they are usually badly prepared, and themselves be able to reap the benefit of improvement.

7. The next subject which we may consider as deserving encouragement, is that of the crops themselves, both in respect of the quantity as well as the quality of the several cultivated products. This will, of course, be different in the varying soils and climates of the Presidency. Much may no doubt be done in this direction by the Native cultivators, if they feel inclined, for instance by the selection of the best kinds of seed in their own districts, or by interchanging such with similarly selected seed of other districts, so also by the more careful culture of the soil, eradication of weeds, thin sowing, drill husbandry, rotation of crops and though last, not the least important, by the application of suitable manure. All of these practices, the Natives of some districts at least of India, are well acquainted with, but in the proper use of them few Europeans in India are able to advise, as they have not usually studied or practised Agriculture, and are apt to think that improvement consists in the introduction of European tools and practices into tropical countries; without in the first instance proving that these are the most eligible. The American planters found the culture of Cotton in the west of India well suited to the plant, the soil, and the climate; and therefore turned their attention latterly chiefly to the cleaning of cotton. It appears to me that much good would result, if careful enquiries were made respecting the Native mode of cultivating different crops, and pointing out such as were most successful by the results which they produced.

8. So also with regard to the tools employed by the Natives in their Agriculture. They seem rude, but they are cheap. The chief enquiry should be, are they effectual for the purposes for which they are employed. Thus the Collector of Cuddapah says, that the Agricultural implements in common use in the district,

are of a very rude nature, "though they answer the purpose exceedingly well." Some of these implements are no doubt susceptible of improvement. But such improvements can only be made by those well acquainted with the working of the several tools, and in the direction in which, and the extent to which charges require to be, or may be carried. The simple introduction of English ploughs, which has been so often tried, is of little practical value, for they require larger cattle than are commonly used, and those must be supported on better food than is usually supplied to Agricultural cattle in India.

9. It is quite possible, however, for the Natives, if they pleased, to grow crops which would be valuable either for sale, for cattle food or for manure: as for instance, several of the oil seeds. These are already grown, as being useful to the Natives for their oil, or as exportable articles; but no where I believe to the extent that is practicable. A part of any extra crop of these oil seeds might be sold, but a part or the whole might be expressed, and the oil only sold. The residual oil cake would serve for food for cattle, and the manure from these animals, if not burnt, would be useful for fertilizing the much impoverished fields. Or if the farmers pleased, the oil cake would itself serve as manure since it has been found from numerous experiments made in this country,* that oil-cake is one of the best manures for cereal crops. But I propose shortly calling attention to this subject, as it seems one likely to overcome a pressing difficulty.

10. The third head under which the improvement of districts may be considered, is that of the introduction, and culture of new substances, or of such, as though common in one district, are unknown in another. This is a department in which, no doubt, much may be done for increasing the comforts of the people, either by bringing within their reach, articles of culture which may be consumed on the spot, or furnishing them with products which may be valuable for export; and enabling the people to exchange them for the valued products of other countries. But much caution is required in recommending for culture, any articles, which though

* *i. e.* in England.

valuable in one district, may fail in another, merely from too rigidly following the mode of culture which is found most suitable to another district, where some little observed circumstance may differ. For successful culture depends upon a due consideration of soil and of climate, as well as of a due adaptation to these of the modes of culture.

11. Not only however must the culture succeed, but there must be a demand on the spot for the article produced, as is well observed by several of the Collectors. Thus, the Collector of S. Arcot says " I do not believe that anything short of an assurance " that a remunerative price will be immediately given, will induce " the Natives to attempt the cultivation of any novel species of " produce." Coll. p. 10. So again in Tanjore the Collector writes, that the " Collectors have no desire for speculation, and no faith " in mere assurances that articles fitted for the European trade " will meet with a ready sale at Madras, I believe that nothing " will overcome this scepticism but the presence in the Provinces " of the Agent of some Mercantile firm, prepared to pay in ready " money for all produce suited to his purpose. In Rajahmundry, " in Vizagapatam, and in Ganjam, the Sugar Works are thus car" ried on, and in Cuddapah many lacs of Rupees are annually ex" pended on account of Madras Merchants in the preparation and " purchase of Indigo." Coll. p. 123. From Canara the Collector writes " In this district the Ryots want little encouragement to " cultivate any articles, beyond a certainty of remuneration. But " it is of no use to tell them that an article is of value in a distant " Market. This is nothing to them, the only question is, if they " produce it, will any one give them money for it here. If they " will, they will produce it immediately." Coll. p. 159. Thus he states, " that he considers the *Sunn** or Indian Hemp (probably " *Crotolaria juncea*, or *tenuifolia*) to be the article which promises " best, and has a full belief that if there shall be a steady demand " for this article for the next two or three years, instead of being

* *Note.*—Specimens of this Canara Sunn having been examined by Practical Men, both in England and Ireland, has been pronounced to be well suited to the English Market, but it must be as cleanly prepared as the sample specimens.

" raised in a few villages on the coast to supply the fishermen with " nets, it would become one of our staple products. Almost all " the land flat enough for rice fields has been taken up, but we " have many thousands of acres of land of the same quality as " that upon which the *Sunn* is growing, lying unoccupied." Coll. p. 156. He adds we have lately had an instance in the case of Fish-Oil, and the neighbouring country affords one in that of Coffee, that a brisk steady demand is all that is wanted to introduce a new article of commerce. Coll. p. 182. So the Collector of S. Arcot writes " a few years ago the ground-nut called Manilla " Kotay (*Arachis hypogæa*) was unknown hereabouts, but no " sooner was a remunerative price offered on the spot by a Mer- " chant of Cuddalore for such produce, than it was extensively " cultivated, and the oil from it largely exported." Coll. p. 110. Hence it is evident that in proposing to the Natives to grow new products for foreign Markets, it is not enough that these are valuable and in demand in such Markets, but we must take care that there are local Merchants who will at once take them off the hands of the Native Cultivators.

12. The same observations will apply, but in a still greater degree, if we wish them to cultivate articles, not known in European Markets; that is, such as are possessed of valuable properties and which might become important articles of commerce, from being likely to be useful in many established Manufactures, for instance a new dye, an oil seed or a fibre, as all such are in constant demand and would be readily employed by some Manufacturers. But if sent into an English Market with only their Indian names, and some account of their properties, they would be pronounced to be of "no value" because "unknown in the Market." In such cases, the substances which have most chance of being employed, are those which are most like in properties to others which are already in use; and for which they might be employed as substitutes, especially if they can be sold at a cheaper rate, and are likely to be supplied in large quantities. Some articles which have long been known experimentally would at once be employed by Manufacturers if there was any assurance of a regular supply,

as the vegetable butter of Canara, or the oil of either species of Bassia, known as the *Illuppu* and *Mowah* trees. So also the *Sunn* fibre of Canara, if prepared like the "Wuckoo Nar" of Travancore, or the best hemp of Bombay would find a ready market. Other substances which are less known, must go through the same course that these have done, before they can be enquired for. That is they must be reported upon, written about, experimented upon by Manufacturers statistical information respecting prices and probable quantities supplied. After such a course the enquiry probably would be "why, if there are such things, do they "not come to us, as we are ready to employ them." For this is the case at present with the above vegetable fats, and the Rheea fibre which is identical with the much valued product called China Grass.

13. It is no doubt in consequence of the numerous difficulties met with in attempting to improve the culture of a district or in introducing into it new or little known articles, that some Collectors have recommended the establishment of experimental farms. Thus the Collector of Masulipatam states that "to a great degree the "Ryots of this country require as much teaching as children, "when any new product has to be introduced. Were there any "experimental farms under the charge of some one thoroughly and "practically acquainted with the best mode of raising and bringing "to maturity different classes of valuable products, much valua-"ble information as to the productions, really best suited to the "soil and climate of each district, would be obtained, and the "Ryots would be more encouraged by the actual sight of the pro-"duce grown on the Government Farms than by a thousand orders, "or the most benevolent advice from the Collector and his subor-"dinates." There is no doubt that much good might be and perhaps would be produced by such experimental farms, if they were efficiently, and also successfully carried on. But they would have to be successful not only in producing good crops, but also in proving that these were profitable ones. This there is great doubt of there being for some time, in consequence of the extreme difficulty, if not impossibility of finding well informed and efficient agents

to take charge of them. For almost any one that was appointed, would have much to learn, before he would be in a position to teach. The expense of such a process, carried on in several districts at the same time, would be a bar to its adoption, besides that the several failures which would at first occur, would, for some time at least, operate as a discouragement against the adoption of some, even of their successful experiments.

14. The Board of Revenue suggest the propriety of ascertaining whether the Government Cotton Farms have really exercised any permanent influence, and whether the cotton of the Districts in which they were established is sensibly superior to the produce of districts not similarly favored. On this it may be observed, that the inferences drawn from attempts to grow an exotic species of cotton in all the different parts of India, would hardly apply to farms intended to grow only such things as are suitable to each particular district. But even with this exotic species of cotton, it would be found that the Government farms have produced permanent effects only where the climate was suitable to the American species of cotton. For instance, no effect will be observed from the farms which were established in the Bengal Presidency, as the climate was not suitable to the plant; still less so when it was cultivated according to American methods, and all the farms were given up before suitable modifications of culture could be determined on. In Broach great success has attended the cleaning of cotton by Amerian machinery, while in Dharwar and neighbouring districts 60,000 acres are under cultivation with American cotton, which brings the highest prices of any Indian grown cotton in the English market. In Coimbatore good cotton was produced and at a remunerative rate, according to Dr. Wight's statements. If the uncertainties of season have not thrown discouragements in the way of cultivation, some permanent effects ought to have been produced, though the Natives there, seem never to have taken to the culture of American cotton as in Dharwar, and though the Government engaged equally in both districts to purchase all that the ryots would grow.

15. As considerable difficulties would be experienced in the

establishment of experimental farms and the several districts of the Presidency, they would probably prevent their influence being so extensive as might be wished, and therefore render inadvisable the establishment of such farms. But there is a great variety of useful and very valuable information, which is at present required, and which can be only attained by means of one or more experimental farms, and which when obtained might be made applicable to the improvement of the culture of various districts. First, in ascertaining the best methods of culture of the different Indian crops, according to the practices of the Natives themselves in the parts where any crop is best cultivated, comparing these with the principles and methods of culture, at present most approved of in this country; in ascertaining the peculiarities and advantages of the different methods of culture, of cropping, of rotation, &c. together with the use of such manures as are procurable; trying the merits of different tools; and making known the easiest methods of raising water; and in addition, introducing the more valuable articles of culture from other parts of the world, which have any similarity in climate and vegetation to India. Such experiments are too often confined to introducing English cereal crops, vegetables and fruits, into situations where the soil and climate are so dissimilar that any great success is hopeless. If such an experimental farm were established near the Presidency under a Government officer, and at the same time in connection with the Agri Horticultural Society, it might also be made a school of instruction in the principles and practice of Agriculture for young men from the Provinces. These might be selected in the first instance by the several Collectors, and then sent to the Presidency, where they should, like the Native Medical Students, pass through a course of elementary, scientific and practical instruction, and like them be subjected to examination. If they passed such an examination satisfactorily, they might then be sent back to the Collectors for appointments in the several districts, of different natures, according to their respective merits. Such a course would, without any great expense, introduce throughout all the different parts of the Presidency a body of tolerably well qualified individuals, who might be the medium of communication between the Collectors and Ryots in all matters relating to improved

culture; and might themselves superintend an experimental field of any particular culture, in order to give a practical proof to the Ryots of the mode as well as of the advantages of the new culture. It has been found advantageous even in Ireland to send round a body of qualified instructors in improved farming and flax culture.

16. Further, the Board of Revenue call attention to the fact, that several of the Collectors suggest prizes for the improvement of cattle, sheep, &c., and as they consider it a matter of great consequence, recommend its adoption. They also propose enquiring whether it would be advisable in some districts (as Tanjore, &c.,) to introduce a few cattle from other districts at the expense of Government. Thus the Collector of Tanjore writes, "there is probably no part of the habitable globe, and certainly no part of India "which produces such miserable animals, as are commonly used "here. The whole country being under irrigation, there is no pas- "turage whatever. During the time of the cultivation they are fed "on the last year's straw, and when the harvest is over they are "turned into the fields to find what subsistence they can on the stub- "ble." Coll. p. 124. The first observation that presents itself on reading this statement is, that not only is it not surprising that the cattle should be reduced to this state, but it is hopeless trying to improve them, unless some better food than the dried rice straw of one season and the stubble of the next, is provided for them. The improvement of the breed of cattle and of sheep is now conducted on scientific principles by careful observers, but in no case I believe do they attempt to make crosses and raise the character of a breed, without at the same time taking care that food is supplied which will suit the improved breed, whether it be of sheep or of horned cattle. The Board observe that the cattle of Nellore, Mysore, Coimbatore, &c., and the buffaloes of Canara are known to be very fine, and a little judicious expenditure in this way might be productive of much advantage. Having called attention to this subject in my essay on the Productive Resources of India, p. 139 and 161, I would beg to refer to the principles laid down by different breeders. Among the first of these, is the great importance of climate, secondly of pasture. You must first of all be in possession of a pasture suitable for the new comers, &c., also to the objection of breeding *in and in*,

and to the advantages of bringing the breed to the required size or fineness by one or two crossings, rather than attempting at once what we may wish for ultimately. But the subject is well understood in some parts of India, as is evident from the greatly improved breeds of horses and of cattle. The latter both in Harriana in the North-West of India, and in Mysore. The officers in charge of such establishments should therefore be consulted on the best course to be pursued.

17. It is probable that the Natives might be induced to grow some crops which would themselves be profitable, and the refuse useful as food for cattle, for instance the *Sorghum** of which the stems are nutritious, and given to cattle in different parts of India, and as I have suggested, oil seeds might be cultivated, of which the oil might be sold and the cake given to cattle. The Experimental Farm would be useful in eliciting information as well as in confirming and recommending whatever practice was most approved of.

18. Further, a very excellent suggestion, and likely to be productive of useful results, was made by the Collector of Madura, and considered worthy of adoption by the Board of Revenue, that is, that Government should at their annual meetings for the distribution of prizes, take advantage of the opportunity of exhibiting models or specimens of improved implements, such for instance, as simple methods of raising water, improved methods of cleaning cotton, or of separating fibres, models of oil and other mills, &c. according as might be thought advisable in different districts. The Collector of Madura suggests some Carpenters' tools, also ordinary Ironmongery such as locks, latches, &c. The Board of Revenue also suggest the exhibition of improved produce from other districts, as desirable for a district where a new culture is proposed or commenced. All these are useful suggestions, and very important in a country like India, where, though some of the Arts have attained a high degree of perfection, others have remained in a rude and unimproved state for ages. From the advance which the Natives of India have made in so many of the Arts and Manufactures, there is every reason to anticipate that they will do so in

* Jowari or Cholum.

others, indeed this is proved by their imitation of European Arms, Ship building, &c., and by the very remarkable fact of two Natives, named Soobaroidoo and Venkatareddy of Dowlaiswarum having, in the preliminary exhibition held at Rajahmundry, exhibited two *working models of Steam Engines* made by themselves; upon which the Right Honorable the Governor in Council observes—" It will " not be the least valuable result of the large Engineering Works " in the district, that they have tended to introduce among the Na- " tive community a taste for Engineering Mechanics, and a know- " ledge of the subject which, especially at the present time, is like- " ly to be most valuable." At the same meeting a Power Loom imported by Mr. G. H. Faulkner, was the great point of attraction, and its operations were earnestly watched by thousands.

19. In conclusion " the Board consider it of great importance " that (these) difficulties should not be overlooked, but they view " them not as symptoms of ultimate failure, but as indications that " the measure must be carried out with steady perseverance, and " that no want of success at the outset must be allowed to cramp " the efforts of Government." It remains only to add that the proposed measures for the improvement of the several districts, as well as the lists of their products and the prizes to be awarded for them, as well as the results which are obtained, should be printed, in order that the information may be generally diffused.

20. The two preliminary meetings in the districts of Guntoor and Rajahmundry, having been as satisfactory as could have been expected with so little previous notice, it has been proposed to hold during the year 1856 nineteen agricultural exhibitions in different districts of the Madras Presidency, and as the Governor General in Council has confirmed the expenditure of 58,000 rupees for the purpose, the measure promises to be as useful as any other public work in India.

Connected with the correspondence respecting the establishment of an Exhibition of Arts and Manufactures at Madras, and of others for the distribution of prizes for agricultural products in the pro-

vinces, is a recommendation from the Government of Fort St. George for the establishment of a BotanicalGarden at Madras and for the employment of not less than two able and experienced Botanists and Mineralogists who should be kept continually moving about the country, in order that a thorough knowledge of the rich and varied productions of Southern India might be rapidly acquired and turned to account.

In the Minute of the Right Honorable the Governor, regret is expressed that nothing more (that is than assisting the Agri-Horticultural Society) should have been done by Government for gaining an extensive and practical knowledge of the botanical productions of this province, that is the Madras Presidency. This observation appears to me should have been qualified with the words "at present," for I believe that much has been done at different times, and that we possess as good a knowledge of the Botany of India including the Madras Presidency, as of any other extra European country. Much of course still remains to be done as in most other countries, but the want at present is rather to systematise and to render easily accessible to the public the information that has been accumulated, than to make investigations by the aid of those who would have to spend some time in becoming acquainted with what has already been done, before they could proceed to make new discoveries. That I do not take too favourable a view of what has been done, it would be enough to refer to the preface, p. XI. of Dr. Wight's Prodromus to the Flora of the Peninsula of India, where the labours of Kœnig, of Anderson, Berry, John, Roxburgh, Heyne, Klein, Buchanan Hamilton, and of the venerable Rottler, are referred to. Of these, several were supported by Government in their investigations. Dr. Wight's own, though incomplete work, is itself a record of what has been done to a certain extent, and no better service could be done for diffusing a correct knowledge of Peninsular Botany, than the completion of this work. In his illustrated work "Icones Floræ Indiæ Peninsulæ," he has given excellent representations of about 2,000 Peninsular plants, independent of 300 plants figured by Dr. Roxburgh in his Coromandel plants and those in Rheede's Hortus Malabaricus. Dr. Cleghorn,

Professor of Botany at Madras, has himself made extensive Collections and numerous drawings of the plants of the same part of India.

Instead, therefore, of employing Botanists from Europe to make fresh investigations, I conceive that it would be much more beneficial for the diffusion of a taste for, and a knowledge of, the vegetable productions of the Peninsula, to employ a man like Dr. Cleghorn, who is as well qualified for the task as any man likely to be found here, to prepare a manual with brief characters of what is known of the Botany of the Peninsular. But contrary to the opinion of Dr. Wight, expressed at p. XXIII. of his preface, I would advise the careful addition of the Native names of plants, as I have always found, that such as are of use and are therefore important, have names by which they are well known to the Natives. These names no doubt differ in different districts and applying them may be more troublesome in the Madras Presidency than elsewhere, from the languages differing so much in different parts, but this very fact makes the task more necessary. If Dr. Cleghorn, could afterwards, or even at seasonable parts of the year, make excursions into neighbouring districts, he might usefully make any observations on the Geographical distribution of the plants of the Peninsula, especially as connected with soil and climate, as these would give principles for the cultivation of some and the introduction of other plants.

The above point is independent of that of the establishment of a Botanic Garden at Madras which is recommended by the Right Honorable the Governor. This however is not the first time that there has been such an Institution at Madras, for without referring to the times of Dr. Anderson, there was formerly, if I am not much mistaken, a Botanic Garden at Madras, of which Dr. Wight was Superintendent at the time that it was abolished, that is when Mr. Lushington was Governor. This, however, does not militate against the establishment of another Garden with definite objects, that is for the introduction of useful plants of other parts of India, or other warm countries and for the culture of Horticultural and Agricultural Products. This I would therefore call an experimental

rather than a Botanical Garden, though it might be appropriately placed under the superintendence of the Professor of Botany with the aid of a well educated gardener who would more readily learn the peculiarities of Indian culture than any one not so educated. This is well evidenced in the case of Mr. McIvor, now in charge of the Garden at Ootacamund, and whom I selected out of several candidates, as he combined in the highest degree, a knowledge of the principles with the practices of Horticulture.

Though fresh Botanical investigations do not seem to me to be necessary at present, it is very different with Mineralogical and Geological enquiries, for the Madras Presidency is filled with mountainous ranges which abound in Geological treasures, a correct knowlege of which as of the Rock formation, is greatly required. For this purpose one or two qualified persons might well be appointed; and if one excelled as a Geologist, the other should be well qualified as a Mineralogist, having sufficient knowledge of Chemistry, to be able to give a good account of the various soils which might be met with. All such information would be practically useful by affording data for the improvement of the Agriculture of the several Provinces.

VI. *Journal of an Expedition over the Annamullay Mountains for the purpose of examining the Teak Forests, and ascertaining by what line the Timber could best be carried to the Coast. By* Captain Frederick Cotton, C. E.

Left Cochin at 2½ P. M. in a boat with 10 oars, the tide and wind in favor. Reached Allwye before sunset. The river there becomes shallow, but the boat, with the crew out of it, was taken over the shoals without difficulty, the tide being at the time about half flood. From Allwye to Sheura (4 miles) the river is very shallow, but the boat was hauled over the sand-banks in a foot or 15 inches water. At Sheura, the Rajah of Cochin has a bungalow, and he is now living there for bathing; which he has the good taste to prefer in fresh water and comparative solitude than in the brackish water and most miscellaneous mob at Allwye the fashionable watering place of the Cochinese, who at this season emigrate there in great numbers.

Allwye has one essential as a bathing-place, which is, that the water is so shallow an infant may learn to swim in it without danger; but beyond this, I see no other advantage in the small stream to make up for its dreadful popularity. Above Sheura the river makes a bend by which at least 3 miles are lost in distance, and as I met with several shallows in different parts of the stream my progress was so slow that it was nearly daylight before I reached Malliatoor. The Allwye river is very much in character like the upper part of the Baypoor and Cotiaddy rivers of Malabar; but the banks are lower, and the country on either side differs, in the absence of those laterite knolls which occupy so great a portion of that district.

Malliatoor is a small village belonging to Cochin, on the north side of the river, inhabited by Roman Catholics, whose houses are exceedingly good, as should be their morals also, seeing that

in this Parish of some fifty houses, there are no less than three Churches. On enquiry however, it appeared that the whole respectability of the place depended upon its active smuggling trade, which works so successfully for those engaged, that its ecclesiastical endowments are well supported.

On the opposite side of the river, the Travancore Circar has an Establishment for working the neighbouring forests; from which 800 logs of Teak are annually exported. The Conservator has a bungalow here, and though the jungle begins at this point, it is not considered feverish at any season of the year.

Elephants are caught near Malliatoor in pitfalls; and after two years it is considered safe to use them in their old haunts. It is at this season that they are taken, the want of water in the jungles driving them to the large streams; near the banks of which, the pits are dug. Fifteen elephants are kept at Malliatoor for the work in the forests; but after the beginning of January, water becomes so scarce in the hills, that they can no longer be employed. I find that there is a well-beaten path from this to Annamullay in the Coimbatore district which is kept open by the smugglers who bring Tobacco from the Palachy Talook, for sale in the Cochin Territory.

On the 7th, I visited the Malliatoor Hill, which is only marked in the printed map as a Theodolite station, but is not named. For the first mile and a half, I walked over cultivated fields; but beyond them, I began an ascent which continued for a mile, and brought me to the summit of a rocky knoll, having a command of an extensive view. To the westward I could distinguish every thing as far as the line of coast, but eastward, there was nothing to be made out, save a confusion of low hills, buried in the densest forest. None of these appeared to be of any considerable elevation; but in the sameness of colour, and absence of all marked features, it was difficult to judge either of height or distance.

On the rocky hill I had ascended, I found a very filthy little Church, which bears a character of such excessive sanctity, that it is said to be visited every Easter by from five to six thousand

Pilgrims. I could not ascertain what had gained for the little hill the respect that it received; and could only guess that in their adoration of the type for the reality, the rubbish and confusion of the place might be considered typical of the Cochin Christians' creed. No one lives upon this hill, but the Chapel has a weekly visit from the Priests at Malliatoor: who at other times leave the Chapel to the care of a converted herd of Ibex; which graze on the steep hill-side, and shelter in the sheds and outhouses.

I saw fifteen of these very ugly goats about the knoll, all males, which was remarkable, and I should have entered them in this my diary, as having instinctively monastic habits, had I not been told, that there were many more in number of the other sex just out of sight amongst the bushes, which silenced the suggestion.

These civilized members of a forest family have not lost all the habits of their race in general. They saunter with composure on edges as sharp as knives, and stand with all four feet upon a single point of rock. Nor are they in character less wary than the Ibex tribe in general. Their cunning teaches them that they are safer in the sanctuary of the Church, than on their wonted haunts, the precipice; and having taken up their abode upon the sacred hill, they bask in perfect safety, as if aware that it was consecrated. In one of the Chapel offices, a black buck was lounging on a bedstead, who knew his place better than to take any notice of the Heretic intruder, and such was evidently the feeling of the herd in general. This seems to speak of good intelligence, yet judging by the head and face, the Ibex is a sheepish jackass. Dull as these animals appear, they are said to have all the cleverness of Priests, and when any thing goes wrong on the hill, one of the old bucks goes down immediately to report it in Malliatoor. Only a few days ago, one of these vigilant bergers is said to have taken the three mile walk, to ask a man in the village when he meant to pay that silver elephant he had promised to the Church if the pitfalls he was digging should prove successful. An elephant having been taken, and the vow forgotten.

28th March. A guide has arrived who gives the following

statement of distances, and says that there is no open space after Toonacadavoo is passed. (From Malliatoor the river turns to the southward of east, and is no further navigable for boats, at this season.) To Attripully 20 miles north, Amakimtodoo 20 miles N. E., Oracumbum river 6 miles N., Yeddapally 20 miles N., Toonacadavoo 20 miles N. E., Annamullay 12 miles N. E. Total 98 miles. I know however that Attripully is not further than 12 miles; and the printed map gives me so much confidence in the rest being still more over-rated, that I shall dismiss all the people I can spare, and make the attempt; particularly since it is possible that the Tobacco monopoly may shortly end its days, when this path will close for want of use. If it was not for this man's statement, I should reckon upon one night only in the jungle, and the second I should hope to be at Annamullay.

The guide who has come forward to take me through the hills is a sturdy little smuggler with legs that look up to a mountain scramble; and with eyes that betoken more than the ordinary intelligence of southern Natives. When he was brought to give me what information he could, (or rather *would*,) I heard his voice at some distance round a corner, but could not see what sort of man I had to trust to; and twice I begged that he would show himself, without my wish being gratified. On inquiry into the cause of this, I found that one of the party round me was a Brahmin within 20 yards of whom it was not lawful for a *Teer* to stand. This little matter of etiquette being disposed of, I requested my Brahmin friend to take his leave that I might talk with more freedom amongst my equals. This Brahmin however, soft and effeminate as he appeared, was evidently on the same subject a man of information too; and unless he had a wonderfully retentive memory for tales of travel, had more than once crossed the hills by the smuggler's path. It would not however have been altogether right in me to suggest the possibility of his acting on free-trade principles, which in this little state rendered a man liable to hard labor on the roads in irons; and after being indebted to his civility for the knowledge of my little smuggler chief's residence, it would have been gross ingratitude to hint that his sacred

limbs ought by law to have been *wearing chains*. I think it was rather to the annoyance of all present, that I made up my mind to start on the trip; but promises of a liberal present to my guide, and double pay to all the coolies who accompanied me, satisfied *them* if it did not suit those so well who had nothing to gain by my expedition, and might lose a profitable trade if Malliatoor becomes a thoroughfare.

28th March. At 4 o'clock on the following morning, I set off with Mr. Hamnett, the Civil Engineer's writer, who volunteered to accompany me, a servant also mounted 6 or 7 people to look after the horses, &c., the smuggler guide and 16 coolies carrying about half a load each. Having crossed over the village, we followed up the course of the river for about a quarter of a mile, then entered the jungle and travelled nearly due north. For the first two hours we got on very slowly and lost some little time in consequence of a peon having played us false about our torches; a trifle that might have made a great difference in the up-shot of one day's work, had we found the journey as long as we expected; for our guide had given us to understand there were but few places where water could be found; and our moving after dark without lights was out of the question.

As I rode I kept a Memorandum of all the beds of streams we passed; such changes as took place in the growth of the jungle; the nature of the country we were passing through, and, as well as I could, the general direction of the path we travelled. That memo. I will place on record, in case any one who succeeds me in my office, should wish to follow up the examination of the hills.

The jungle on this side is of large timber trees with a good deal of underwood every where. In some places indeed it was so blocked up with the prickly head of the ground rattan that off the pathway it was perfectly impenetrable. For the first nine miles there was very little bamboo and no teak.

The soil was black and moist, even at this, the driest season of the year.

We passed in this space four nullahs, three of which had water in

them in puddles here and there; and one about the seventh mile, had a small stream running to the eastward. We crossed two low rocky ridges from 30 to 50 feet high, but the road was remarkably even upon the whole, till we reached the tenth mile, where we made a steep ascent; and crossed a saddle perhaps 150 feet in height, with hills on both sides. At this point a cut has been made through the narrow edge of the ridge to drag timber through, and the coolies knew it by the name of the Attripully Fort, though in passing it, I could make out no enclosure nor anything artificial, but the cut I rode through. It may however be that there is an embankment which runs along the ridge, as lines of fortification of this kind are found in all these Western jungles, even when the appearance of the forest otherwise, would lead us to suppose that man had never entered it. From this ridge we descended rapidly into a bamboo jungle and in about ¼ mile came to Attripully Fall.

At this point a guard of four peons is stationed by the Travancore Government as a check on smuggling; an establishment so far successful, if my *Teer* guide's information is correct, that the gangs, wearied with their journey, very generally, throw down their burthens here, and give themselves up to sleep, while the peons are cooking for them, and small blame either to the guard which might be raised to ten times its present strength, and would be still unable to resist the force, the smugglers on this path could bring against it. From the account these peons give of the fever at Attripully, I am inclined to think that though appearances are in favour of its being as unhealthy as a dense bamboo jungle could be, it is not by any means so bad as might be imagined; and our experience teaches that no one can say, except from actual trial, what are, and what are not, the spots where fatal fever may be found. Of the four peons stationed here, one was said to be absent with an attack of fever then; but it may very well have been that he was busy cooking for a smuggler's party or doing a little business in the trade himself. One man in four after a four months' residence is not so very bad a bill of health, considering how the men are housed, even supposing (what was most

improbable) that their tale was true. Indeed from all I heard at Malliatoor about the fever, the forests on this side are not so dangerous as those particular jungles of Malabar, which we consider really fatal. It is true people talked of fever and men are said occasionally to die of it; but still it is not dreaded like the Carcoor fiend, or that awful pest at Bowally. And were I to make this trip again, I would not hesitate to spend a night at Attripully.

At this place the Codacherry river takes a sharp bend, and a $\frac{1}{4}$ of a mile above the turn there is a very pretty fall of 60 or 70 feet in height, very picturesque even now, when the water in the river is at its minimum. There is a specimen here of the effect of pebbles lodging where the rock is somewhat soft, and by the action of the water wearing holes into the river's bed, many feet in depth. The whole bed of the stream is perforated in this manner both above and below the falls; and several of the pits, after working down some fifteen feet, have broken through and left a flat arch of rock spanning five yards or more, with a large open space beneath, through which one branch of the river flows. This rill leaves the main stream by one of these tubular perforations and then passes below the rocky arch. It is altogether a curious spot and very picturesque. We stopped here two hours to rest and breakfast; and an addition was made to our party of two of the watching peons, come by orders of the Malliatoor Ameen to learn the road, and keep the information we obtained, for the use of any one who should wish to try the path hereafter.

The peons seemed terrified on hearing what they had to do, though one can hardly fancy why men living as these were, in a hut built in the branches of a bamboo bush, deep in a jungle full of elephants, should fear a change so trifling in their home, as they would find with us. But so it is; beyond this point they had never been, and they dreaded the unknown as much as if they had never left the pavement of a gas lit town.

As we gained the summit of one low hill upon our line of march, the guide pointed to the flat surface of the rock upon the right hand side and said "Many years ago a Christian Bishop was killed upon that stone."

He did not know the name or nation of the man who died there, but seemed to have some reverence for the spot and spoke of the murder as a martyrdom.

Our road to this had been due north, or nearly so, and by our reckoning we had travelled 10½ miles. We now turned to east, north east, and left the river, though by the printed map the stream flows very parallel to the course we took. The path was well trodden all the way, and there were fresh notches on the trees showing that the smuggler had passed it the day before. This plan of notching the trees as they pass along must have been adopted by the smugglers when the path was less open than it is at present; for the road is now so clear that a horseman might canter along the whole of it. The traces of elephants though seen everywhere, were none of them very recent, proving beyond doubt that we were not near the banks of the large river. This had one advantage that it saved us from the risk we had run in riding to Attripully, of going when we least expected it, into well secreted pitfalls; which here and there, so completely "opened" the road to all that came, that we had cause to doubt from step to step the ground our horses trod upon. The pitfalls are of course dug where the elephants most frequent the forest, and at this season, as the minor rivulets are dry, their haunts are by the largest streams. After riding five miles we came upon a heap of teak timber, which had been cut a few years ago by the Cochin Circar, and left there, after they gave up working the forests. Now this, our guide, said was cut in a place called Nelliampoyd, but where that was he did not know. This was bad news, in one respect, for it showed me beyond a doubt that if I followed him I was not to go the path I wished most to see, that which led west of Annamullay. There was however, nothing to be done, the guide knew one way only, and that of course led to where tobacco was grown in greatest abundance east of the town of Annamullay.

In the first part of our ride there was a sad want of water, and when the trees did not meet over head, the heat was excessive; but where the shade was good, the temperature was most agreea-

ble. From the absence of nullahs, we appeared to be following a ridge, and the direction was due east.

The path continued very level till we had travelled about $5\frac{3}{4}$ miles; when we began the ascent of a hill called by our guide Sholamooddy. The first ascent, which was at a slope of about 6 or 7 to one, occupied a quarter of an hour, after which, the rise was gradual for one mile and a half; the whole height being perhaps 350 feet. After turning the summit of this we descended rather rapidly for a few minutes, and came to the river which was reckoned upon as the end of our first day's march; if we were to be three days in getting through; and the coolies had been preparing me for a halt by complaining of fatigue. But I was to be saved a day in a way I least expected. As we reached the nullah the guide came running back with his hand over his mouth, and said in a whisper that the place was occupied by a gang of smugglers, which frightened the coolies out of their fatigue at once. I sent the guide on to tell the smugglers that I did not want to see them, and if they did not wish for a meeting, they had better get into the jungle out of sight; which they did, leaving one man at the edge of the wood to see, I suppose, what sort of party we were and what we did with the loads they had left. To my delight the coolies now pressed on; I counted the loads of 30 men, but had no further communication with the party. After two miles more, we came upon a small stream, and the guide reported another gang. These men all left the ground but one, who was the leader of the party, a fine manly looking Nair who evidently had too much at stake to be easily intimidated. The tobacco to the amount of about 30 loads was in heaps undergoing the operation of sorting, and was very lately gathered, much too wet to smoke, and acrid enough to have cured the most inveterate Virginian of his love of chewing. My coolies however could not overcome their taste for pilfering, and seeing that the smuggler was on peaceful terms with us, they began to rob the heaps, but this I put a stop to, and bought a bundle of the nastiness to satisfy them all; putting myself on a footing with the smuggler chief, and bringing myself under the Cochin Code, within the reach of section this, of regulation that.

After a conversation with this man for some few minutes, we moved again, and very shortly began a long and steep ascent called Kurridy Kutum (alias Bear bank). This occupied us an hour and forty minutes, and was the highest hill we had met with. On the top of this, we had the first clear view, and very beautiful it was. We were on the edge of a spur, with a deep and narrow ravine on the left, and on our right there was a wide gorge with bold hills on either side, and a low but broad and picturesque water-fall lighted up the dark and otherwise unbroken forest.

From the end of this spur we descended by a path almost as steep as could be climbed about as many feet, as we ascended by Kurridy Kutum. At the foot of this we found a fine river, with a large and deep pool of the most brilliantly clear water. This river is known to the smugglers by the name of the Oracumbum, and it is evidently one of the main branches of the Coadacherry river.

Here we were to halt for the night, and if it were not that no one in these jungles can feel sure that he is not breathing poison, a traveller could not wish a more delightful resting place. I believe in most cases it is advisable to drink as little as possible of the water that is found in these very dense jungles, but this was too tempting and too delicious to be resisted, and if we were incautious in swallowing a large quantity of this beautiful stream, I made up for it in some degree by giving a pinch of quinine to every one of the party and taking the same myself.

Nothing could be more suitable for a bivouac than the spot we had chosen, a bed of high reeds grew along the river's bank, affording shelter from the wind which blew up the stream most agreeably for the evening meal; but rather too chilly for comfort or safety in the heavy dew of night. I had a cot with me which I Sir Humphry Davyed by musquito curtains; and as some luxurious smuggler had made himself a bower by tying the head of the tall reeds together, I borrowed his lodging for the night and had the snuggest lair imaginable.

There was very little conversation going on after the sun set, or

if there was, I slept too well to be disturbed by it. I heard no sound till about 10 o'clock when I was awakened by a shout and all the people calling out that there were elephants close by, I left my cot and joined the people on the rocks in the bed of the river, but the only sound I could hear, was the rushing of the stream. I was as angry as people are who leave their beds so hurriedly, and to pacify my wrath, a man got up a herd of Bison on the other bank, where not a leaf was moving. This fancy picture did not take up our attention long, for the real cause of the alarm was close at hand, to set our doubts at rest. The trumpet of an elephant was heard within some twenty yards of us. The people shouted, and I fired my gun, aiming (now I think of it) in the direction of the noise, as if I had a hope my ball would go directly down the throat of the intruder. This did not move the beast, but a handful of dry leaves upon the embers of our bivouac fire sent up a blaze sufficient to alarm him, and we saw him move away, with most unsporting satisfaction. The elephant had come by a path parallel to the river bed, and when the first noise startled him, he must have stopped, and remained quite motionless ; for where he stood was close upon my writer's cot and within five yards of mine, the reeds we slept in being so thick we could not see him through them. It was a merciful escape for both of us. We placed our cots upon the open rocks for more security, and had no further interruption to our slumbers. The smuggler guide gave us a reason for the visit paid us that elephants were in the habit of frequenting halting places to eat the ashes left from the travellers' fires ; a wholesome practice doubtless, for after eating acrid leaves by waggon loads, it must be just as well to take a bucket full of potash now and then.

The position of this halting place is what would be called undoubtedly feverish, but from the account the smuggler gave me, it appears that with the exception of the northern edges of the Annamullays, there is very little fever in the jungle any where. This if true, is a most curious fact, as in denseness and confined positions it has all that suits our notions of " malaria."

The want of torches, and the elephants supposed to be on our

line of march, obliged us to remain till daylight. At six we started, but half an hour was lost in finding where the ponies could get over. The river being formed of blocks almost square, with spaces between them one foot or so broad, and from two to four feet deep the most dangerous footing possible for horses; but favored here again we got over without accident, and were clear of the reeds on the river bank by half-past six.

The country we travelled through from this point is undulating, and the forest, like the generality of what we traversed yesterday, of fine trees with thick underwood. The soil rich, and the air in the shade cool and pleasant. The direction of our march was from east to north east, and the trees had all the fresh marks of the smuggler's knife till we had travelled an hour and thirty-five minutes at the rate of three miles an hour, at this point a path ran to the eastward, but the guide had doubts as to our horses being able to descend a pass to which it led. This pass is called the Kala Kumama; leaving this track we turned to the N. E. and had no longer the fresh knife marks on the road side. The path however, was well defined, and is evidently used by smugglers on some occasions.

We saw here the first teak we met with, and the forest belongs I believe to the Cochin State. At half-past eight, we halted for a few minutes on the banks of the Yeddapara, a considerable river, of indifferent water, about 2½ feet deep where we forded it. This stream was very unlike in character to the Oracumbum, and bespoke a more level country. The bed being sandy and the current slow. This water runs to the westward, like all that we have hitherto crossed, showing that we had still to turn the highest ground of the range. The underwood here is chiefly young bamboo from the seed, which by my guide's account has been in the ground about 9 or 10 years. The age at which the bamboo flowers, seeds, and dies, is very differently given, but it cannot be less, I believe, than 30 years. I have seen several jungles of this plant come to maturity and die, but till now I have had no opportunity of seeing the crop rising again from seed. A great extent of bamboo jungle at the foot of the Koondah ghaut died down four years

ago, and three years passed without any appearance of the fresh plants. This year I have not examined the ground, but from this man's account, and the size of the plants in this locality, I am inclined to think, that the seed does not germinate for several years.

About $1\frac{1}{4}$ miles north of the Yeddapara we came upon the first glade we had seen since leaving Malliatoor. This break in the jungle is covered with waving grass, and scattered trees, it is about $\frac{1}{4}$ of a mile in the broadest part, and extends nearly a mile. The soil is moist, and it is trampled by elephants and bison in every direction; a sounder of hogs crossed our path in this glade, the only game of any sort we had met with, except the solitary elephant at the Oracumbum river. As a general thing, the deep forests of the western coast give shelter to very few animals, and this the broadest belt of forest I have crossed, appears to have less than any; elephants seem to have almost sole possession of the Annamullays. Their tracks are to be seen every where, and though we saw so little of their recent traces, it is to be accounted for, by our path leading us along low ridges too dry for them, at this season, and not to their scarcity in the hills, for every single tree by the way side, which was of sufficient strength to bear the pressure, was covered with the mud that had been rubbed from their backs during the monsoon when they can find water every where and wander where they will.

The teak as we advanced, became the principal tree of the forest, and the growth is superb, far exceeding any thing now left in the district of Malabar. At half past 10 we came upon a strong party of men working for Mr. Gardiner and Gooroobucksing, two Palghat timber merchants, who, as I understand their workmen, are now cutting up and carrying away by permission of Government some teak which was felled here several years ago, when the jungle was supposed to belong to the Colungode Rajah, but which has since been claimed as British property. The facts of this case I am not acquainted with, and if I were, it is no concern of mine; I cannot however, on the plea of its being out of my own division allow to pass unnoticed, the wasteful manner in which this most valuable forest is worked; but I must preface what I have to say

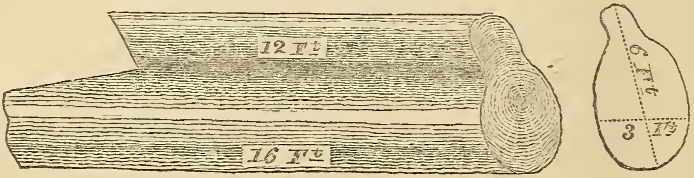
by stating, that I have no acquaintance with the working of Teak forests, nor any knowledge as to the terms upon which this timber has been purchased by those engaged in its removal ; and my remarks if they are of any value, can only be so by leading to an enquiry as to what are, and what ought to be, the means adopted for saving to the utmost this most invaluable wood.

The jungle in which this Teak is cut is the most magnificent forest I have ever seen, in any country, for the straightness and height of the trees, as well as for their enormous girth. Those which have been felled vary in size from two feet in diameter to four, five and even six. Their growth in general is more like the American pine than the oak, as they have clear branchless stems of great length and a spreading head. The underwood is now burnt, as it is I believe each year, and every stem may be examined, as well as if it were lying in a timber yard.

As I rode through the forest in a direct line to save time, and avoid if possible another night in the hills without shelter I could only judge of what was doing, by what happened to fall in my way, but that was quite sufficient to show me, that five-sixths at least of this magnificent timber was totally lost. The order given to the wood-cutters is to send down planks of the following dimensions ;* and the wood which is not suitable for cutting to that measurement, is abandoned to be burnt with the underwood, in the next dry season. The people receiving these instructions seem to consider their work done well, when they procure in a certain number of days, a certain number of planks, without the slightest reference to the number of trees expended in procuring them. They are furnished with axes only, and (whether by the timber merchants' permission or not, I am unable to say,) they save their labour with axe, as much as they are able by the use of fire. In the hurried view I had of the work it appeared that the length

* Ft.		Ft.	In.		In.
30	×	1	¼	×	4½
25	×	1	11¾	×	4½
20	×	1	10½	×	3½
17	×	1	8¾	×	3½

required for the first class plank was cut out of the stem, where it could be got with the least amount of labour which of course was at the sacrifice of the thicker part of the butt. To bring the timber into shape it is squared in some cases with the axe only, but in many others, it is chopped in notches, so that a fire being placed along the side, a flat face is given it by burning off the outer surface. Many whole trees seem to be lost by this process, and I should think that the timber saved was materially injured by the operation, as the heat must destroy much of that essential oil on which the durability of teak seems so materially to depend. The timber has now to be cut into planks by the axe, and it will not be difficult to imagine how much wood must be cut to waste before this is effected, even if care were taken to economize it. The space between the planks is at least as broad as the planks themselves namely six inches ; and in splitting them off, numbers are so much injured as to be unfit to send out of the forest. I saw the remains of one of these trees that was said to have yielded about 6 or 7 planks, which, with a saw, would have been cut into 15 ; and this statement of 6 or 7 appeared to be merely a guess of what would have been considered a good number to be procured from such a stem ; including those which were split and useless. The butt of this tree which was abandoned was of the following dimensions.



In addition to this, the head of about the same length is left upon the ground, and both will probably be burnt when the jungle is on fire during the next dry season.

Whether the forests worked on account of Government are wasted in this reckless way or not I cannot say, but even if the same means are used, with every possible care, the loss must still be something enormous, and when I see that so great importance is attach-

ed to the economizing of teak, that a regulation of Government forbids the cutting of trees under a certain girth, I feel sure that I am not writing uselessly in calling attention to this reckless waste.

I passed through no other fine teak forests belonging to the British Circar, but if I am correctly informed, this belt extends to the eastward, and the value of the timber within the Company's territory is immense. If such is the case, not one tree of teak should be cut, till some European officer of intelligence has carefully examined the extent and position of these most precious forests, and the best means are suggested for working them. But whoever undertakes this will have to give his undivided attention to the work for many months, as at present the hills are quite unknown except to the wild people who inhabit them ; and the smugglers, and Moplah wood cutters, who want no change in the forest management.

Should the Company's forests be as valuable as I am told they are, they deserve immediate attention. The timber of the Annamullays, is evidently at its full growth, and loss of time in cutting will cause a clear loss of money. I would therefore recommend some suitable person being sent to the hills with instructions to enquire into the best means of cutting and transporting the timber, the most advantageous size for moving it with reference to the expense of carriage when compared with its liability to injury if reduced to too small dimensions, and also what extent of forest there is, that an estimate may be formed of the capital it would be advisable to sink for opening roads, erecting saw mills, &c. &c. &c.

With regard to the best means of removing timber, I am of opinion that such a road might be opened through the Annamullay hills, as would admit of very heavy timber being taken through them on wheel carriages. The streams which all flow to the westward could be turned to account for its conveyance, when the fall is not too rapid, and if it was found advisable to use machinery for sawing the same streams would afford the power for working it.

To work these forests with inefficient means, or let them to persons with small capital and no scientific knowledge, on terms which make the value of the timber wasted no consideration, is a sacrifice

of all but a trifling portion of the Annamullay teak; and a loss of what in a few years money will not purchase.

A road from the southern Talooks of Coimbatore to Cochin would be of the greatest importance to that district, and do more for the port than any other improvement that could be suggested. It appears very probable also that on enquiry it will be found, that by opening a pass into the teak forests from the low country of Coimbatore, the same communication continued to the westward will serve both to lead the produce of Poolachy and Odamulla-cottah by a direct line to water carriage, and take this vast amount of timber to Cochin.

A road for timber, on which it would be necessary to move very great weights, should, I imagine, differ in one respect from the line which would be opened for general traffic. The slightest ascents should be avoided at some sacrifice of distance, but from the nature of the country I explored, and the gradual fall in the rivers I crossed, I am inclined to think that the road opened for the heavier timber carriages would answer well enough for other traffic, bringing the produce of the southern Talooks of Coimbatore within 70 miles of water carriage and little more than 100 of the port of Cochin.

From the teak forest I descended into the plain of Coimbatore by a pass opened for the transport of timber, and after riding 15 miles arrived at Annamullay soon after dark.

The distance we passed over, since leaving Malliatoor, calculated by time with a careful memorandum of the rate at which we moved is 57 miles; of which 53 are through an unbroken jungle. This would in most parts of my division be 53 miles of danger from fever, but here I really think the danger is very trifling. At Malliatoor (which at a distance has the character of being feverish) I found very little fear of deadly fever in the neighbouring forest. The smugglers declared to me that they did not suffer from it, although the greater part of them are coolies hired for the occasion and not at all acclimatized. The first I heard of fever, was on the side of Coimbatore where the people cutting timber had in the last few days begun to suffer from it.

I had no means of ascertaining the height to which I ascended in crossing these hills, but my impression is that I was never more than 1,200 feet above the sea.

The smugglers at the Annamullays are more dreaded by the people of the neighbouring country than either the fever, or the wild beasts, which are usually the great cause of alarm to those who pass through the jungles of Malabar. In number they are formidable no doubt. I fell in with 60 in two gangs, and I believe that I did not see more than the average of a day at this season. On the second day I left their principal track, but I heard of their having passed in considerable numbers. They carry no arms, but slings, and the bamboo on which they occasionally rest their loads; and have evidently, from the reputation for ferocity they keep up on policy, and the nature of the country they traverse, little or no use for weapons of any kind. Nairs, Teers and Moplahs are all concerned in this trade, and it appears that a certain number of the latter are engaged with each gang, as a protection against the parties of that race which may be met with on the road. My Teer guide informed me that without them, a gang of his caste might very probably be attacked by one of Moplahs. My guide was a Teer, but the Nairs seem to be more generally the leaders of parties, and many of each gang are men hired for the occasion, who receive five per cent. of the tobacco as their hire. It is evident that men of capital in the open country are the leaders in the trade, and men of superior intelligence and daring do business with them as the heads of gangs, each having with him a certain number of men in whom he can trust. From the statements given to me by the smugglers, their profit is about cent per cent. on a trip which occupies eight days. They buy of course at a higher rate than the Sircar and sell it at a very much lower price. A cooly earns from 2 to 3 Rupees in a trip, according to the load he carries, and the luck he has in selling the bundles he receives as his hire.

The only inhabitants of the hills are, I believe, a quiet harmless race of people, who live without houses, but assemble in considerable numbers in the spot which suits them as a residence for the day or month. I was led to hope that I should see two or three

hundred families on the banks of the Oracumbum, but I did not, as it chanced, fall in with any.

It was a great disappointment to me to see nothing of this wild race, who like the tribes that inhabit the mountain regions of the world in general, are in all human probability the first possessors of the plains. They have been fugitives from the invader of their country, too proud it may be, to bear the slavery they were threatened with : and contented rather to brave the miseries of the previously untrodden forest, than to take the place of menials to their conquerors. This well-founded supposition gives a peculiar interest to the people of the forest every where ; and if the accounts of the "Kader tribe" are true, they have, after an unknown length of time passed in banishment from all that civilized man considers the commonest necessaries of life, still retained some of the finest feelings the human race can boast of.

Since writing the diary from which this abstract is made, I have had some intercourse with the wild people of the Annamullays, and my acquaintance with them enables me to bear witness to their many good and agreeable qualities. They are gentle in their manners, kind and courteous, and always ready to help the stranger who meets them in their forest. And if the shelter they have to offer is but indifferent, their hospitality is greater in proportion to their means, than that of more civilized races; for they will at any moment, and in any spot, build a new house for the travellers, and furnish it completely.

The little houses built on such occasions, are curious specimens of simple ingenuity. They are made entirely of twigs and leaves and grass ; and there is not a stick in them an inch in diameter. Light straight wands are stuck in the ground, enclosing a space about 10 feet by 6. The sticks which are to help in forming the sides of the house are about 5 feet high, while the two which are to support the ridge of the roof may be 7 feet in length. Cross sticks are tied by strips of bark to support the uprights, and form a network for holding the leaves or grass which is to form the wall. The roof has gable ends, and is composed like the sides, of cross

sticks tied together with some of the fibrous barks which seem always to be at hand.

The roof is of leaves, teak leaves being preferred when they can be had. These are laid on like tiles, and as it appears to me they only stay there because their friends the Kaders wish it. It is true that in these dense forests the wind is little felt; but if an Engineer staked his credit upon such a roof, I am perfectly certain that neither his person nor his character would have a square inch to shelter under. The thickness of the roof and walls could not be one quarter of an inch, and the whole material of a house would not be considered a load for the feeblest old woman who picks up sticks to boil her kettle with.

I lived in huts of this kind with my friend Mr. Michael when we were examining the forests, and spent many days in them during the S. W. monsoon when there was constant rain. I will not say that these dwellings were altogether water-tight; but the roof being within reach as we lay upon our beds, we could always with the point of our fingers slip the leaves that were out of place into their right position, and stop the leaks that troubled us.

The furniture of these little houses consisted of a bed-stead, and if required, a table. Both were made by sticking stakes into the ground and tying sticks across, so that a plank or mat might rest upon them; but as planks and mats were not always at hand, the surface of the table or bedstead was formed from a thick bamboo. The Kader holding it with one end resting on the ground, slashed round each joint, driving his bill-hook lengthwise into the bamboo. When this had been done round every knot and joint, a cut down one side of the bamboo laid it open, and it flattened out and formed a strong and elastic mat (if it may be so called,) admirably adapted to support the bedding. Each of these was about 18 inches broad, and two were more than sufficient for a single bed, where such sleep was to be had as we found in our Annamullay wanderings.

One of the characteristics of the Kader was always said to be his love of truth and so we found it on an acquaintance; although on one occasion our faith in it was somewhat shaken; when seek-

ing for information as to a line of boundary, a man of one Kader tribe stood upon a rock, and looking to the dark cloud overhanging us, wished that the lightning might strike him to the earth if that was not within *his* range of forest; and on his leaving the slab of stone another man as earnest in his manner and as wild in gesture, stood on the self-same spot and called the flash to settle the disputed point by smiting him if he was not within his own tribe's limits. It was difficult to reconcile these counter statements; but it was probably a point that had been fought for from the earliest time.

The Kaders do not cultivate but live much on the roots and fruits the jungle yields spontaneously. They do however obtain grain and cotton cloth by barter with the people of the plains, which they pay for in wild ginger, turmeric, bees-wax and gums of different kinds. The mention of bees-wax calls to my recollection a conversation that astonished me not a little. At the time it passed, we were looking at some cliffs in the deep forest about 300 feet in height, against the face of which where reared bamboos with the branches so cut off that they left an inch or two to rest the foot upon, and thus formed simple ladders, not altogether easy to use by the uninitiated because being single sticks they turn round under the weight of those who climb them; but these were Kader staircases, and the use they made of them was most astonishing. By means of these bamboos raised from ledge to ledge, the wall of rock was gained step by step, and where the cliff overhung, the ladder was tied by twisted bark so as to bear the climber's weight. It was a marvel how they got the bamboos to the ledges that supported them; but when I asked the little man who led me through the forest how, after they had got the ladder in position, they could take the combs from the bees that with their vigorous attacks had driven us from the summit of the cliff the day before, he began his story by saying "We wait till there is no moon, and take the darkest night." Imagine the nerve required for that.

These little dwarfish people file their front teeth into points, to facilitate their eating the hardest roots. There is some nerve shown in this too, and we may look with wonder and respect upon the

exiled lords of the ancient land, when we see that rather than serve those who usurped the country they chose to live where the food was beyond their natural powers, and could be eaten only by such a preparation of their teeth. It is possible that in the absence of better arms they reckoned upon these pointed teeth as weapons in case their conquerors should follow them to their mountain home.

I must say a few words as to the consequences of this short excursion in the Annamullays. As it so happened that in 1847 the Coimbatore district was taken within the limits of my range as Civil Engineer of the 7th Division, the Government offered to place means at my disposal for working the forests on the public account. This I did on being allowed to select Lieut. Michael of the 39th Regt. as the Executive Officer. Mr. Michael undertook the work, and carried it out with great energy. The saving in the cost of teak timber has been very considerable; and although it has not been found practicable to substitute the saw for the axe in the preparation of the planks used in ship building; there has not been that reckless waste which characterized the working of the forest formerly.

One good effect of Lieut. Michael's labors in the hills has been the emancipation of the hill people from those who rented the wild products of the jungles, and had the monopoly of all that was brought out of them for barter. This monopoly led to the Kaders being in a state of dependence upon any low country shopkeeper who offered the highest rent for the year. And it may be supposed that under such circumstances they had but an indifferent market for the produce of their labor, while cultivation on their own account was strictly forbidden by the renters.

Mr. Thomas, the Collector of Coimbatore, availing himself of the presence of Mr. Michael in the hills, obtained the sanction of Government for his being invested with the powers of a Magistrate and the discontinuance of the renting system; and thus gave the Kaders freedom either to cultivate or trade, and to dispose of their products to those who offered them the best price.

I wish I could add to this very favorable change in the state of the Annamullays, that it was no longer the resort of smugglers, but unfortunately the Native States of Travancore and Cochin have not yet followed the liberal policy of the British Government in sacrificing the profits of the Tobacco Monopoly to the moral well-being of the people.

SELECTIONS.

New Cinghalese Plants.

No I.

We now proceed to avail ourselves of the permission accorded to us by Mr. Thwaites* to republish the new Plants discovered by him, in the Island of Ceylon and contributed to the Kew Miscellany.

The two following plants occur in Vol. IV. page 1, of that valuable and interesting publication.

The first of the two is a new species of an already established genus. *Epicarpurus*, one of the group of BATIEÆ which after having been included among the EUPHORBIACEÆ has now been rightly transferred to the natural family of URTICACEÆ. The BATIEÆ are well represented in Southern India by *Batis spinosa* of Roxburgh, common in the N. Circars under the name of *Gorati* or *Koriti; Epicarpurus orientalis* (*Trophis spinosa* Roxb.) Telugu name, *Sitanica;* and *Trophis aspera* frequent in all parts of the Carnatic, in Telugu *Barinika*, in Tamil *Piraya*. To the same group also belong the celebrated cow tree of the Caraceas, *Galactodendron utile* or Palo de Vaca of Humboldt and the Jamaica bread-nut tree, *Brosimum Alicastrum*, Sw.

The Indian congeners also abound in a milky juice but it does not seem to be turned to any economical purpose, except in the case of *Trophis aspera*, the juice of which is sometimes mixed with cow's milk and heated to cause it to curdle. Its leaves are employed as a polishing agent by workers in ivory. W. E.

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* Journal Vol I. p. 283-4, Proceedings of March 12, 1857.

On two new Plants, EPICARPURUS ZEYLANICA *and* DOONA ZEYLANICA, *found in Ceylon; by* G. H. W. THWAITES, ESQ., *Director of the Botanic Garden of Peradenia.*

EPICARPURUS ZEYLANICA, *Thw.*

Frutex ramosus, foliis subrhombeo-lanceolatis acuminatis glabris remote spinuloso-serratis, floribus masculis dense capitatis, capitulis oblongis, fœmineis racemosis, pedicellis apice incrassatis fructiferis valde elongatis.

A *shrub* or small *tree*, eight or ten feet high, sparingly spinose, much branched; the extremities of the young branches with a few short scattered hairs. *Bark* dark brown, somewhat rugose. *Leaves* smooth, flaccid, lanceolate or rhomboido-lanceolate, serrated, one and a half to two inches and three-quarters long, by three-quarters to one inch wide, tapering towards the slightly hairy very short petiole, with glandular puncta very minute and numerous. MALE INFLORESCENCE pale yellow; anthers nearly round, with a green spot on the back; *bracts* small, inconspicuous. *Sepals* membranous, obtuse. FEMALE INFLORESCENCE: *flowers* green, on rather long pedicels; *sepals* acute. *Stigmas* with brown villi on their inner face.

The male of the species just described bears a considerable resemblance to *Morus*, and might easily be mistaken for a member of that genus, but it will be seen that the structure of the female plant differs essentially from that of *Morus*.

The ovule in this plant, which at first merely causes a slight protuberance on one side of the ovary during its development forces itself out of it, as it were, and at last occupies the summit of the flower having pushed the upper part of the ovary with the stigmas on one side. It then has the appearance of a naked seed seated upon an enlarged receptacle.

The Peradenia Herbarium contains another species of the genus, allied to the above, but differing in its more rigid habit; the branches, which are of a pale ash-colour, all terminating in spines. The young male inflorescence differs too in being enclosed in rather large brown scaly bracts; and, in the only specimen of the female

plant I have seen, the sepals are large and leaf-like, completely covering the fruit. (It is probably *Trophis spinosa*, Roxb.—Epicarpurus Timorensis, *Dcne.*) *Thwaites.*

We are indebted to Dr. Arnott for the following notes on the genus *Epicarpurus* and its allies :—

Blume, in his Bijdr., p. 488, has established the genus *Epicarpurus* for a plant he calls *E. orientalis*, and for which he cites Rheede, Hort. Mal., vol. i. t. 43 ; this last is universally allowed to be *Trophis aspera*. Blume, in the edition I possess, and the only one I ever heard of, gives us no information as to the relative size of the two cotyledons; but M. Decaisne, in his ' Herb Timorensis Descriptio,' p. 171, says, " M. Blume indique, dans son *Bijdragen*, les cotylédons de son *Epicarpurus* comme étant inégaux." In the *E. Timorensis*, which Decaisne describes and figures in that memoir, the cotyledons are represented unequal, but he adds that in " *Trophis aspera*, Wall. L. n. 4,640," the cotyledons are foliaceous and equal.

I do not know precisely what plant M. Decaisne had before him, but in all that I have examined under the name or similitude of *T. aspera*, the cotyledons are nearly as described by Roxburgh in his Flor. Ind. vol. iii. p. 761, and represented in a drawing in the E. I. C. Museum, tab. 118, viz., " cotyledons two, very unequal, the largest being nineteen-twentieths of the whole embryo, and one side divided *half-way through into two lobes* : the small cotyledon is hid between the lobes of the larger one." If M. Decaisne has, from its smallness, overlooked the one cotyledon, and mistaken the two lobes of the greater one for two equal cotyledons, the difference between his, Roxburgh's and my observations will be accounted for. At all events, I consider that *T. aspera* (and so marked is that species that I have seen no other confounded with it) must be held as the type of *Epicarpurus* of Blume.

In his ' Bijdragen,' p. 507, Blume suggests that his *Urtica spinosa* is another species of *Epicarpurus :* Decaisne adds *E. Timorensis*, and says that *Albrandia* of Gaudichaud also belongs to it. Gaudichaud's character of *Albrandia*, in Freycinet's Voy. p. 709, is too

imperfect to permit me either to affirm or deny this, and I have seen no specimens; but all the species with which I am acquainted, either by specimens or figures, are furnished with thorns and smooth leaves, except the original species (*Trophis aspera*): in all, except it, the ovary undergoes an unequal development, the side to which the ovule is attached enlarging more rapidly than the opposite one; so that the style, which at first is at the apparent as well as real apex of the ovary, appears at length lateral, and the ovule becomes more elevated than the base of the style.

The original and genuine species of *Epicarpurus* scarcely exhibits any tendency to this kind of resupination, and has no spines. To the spinous section I refer *Trophis spinosa*, Roxb. Fl. Ind. vol. iii. p. 762 (*T. taxiformis*, Hook. et Arn. in Bot. Beech. Voy. p. 215, or *T. taxoides*, Roxb. in E. I. C. Mus. tab. 120, and in Roth, Nov. Sp. p. 368), *Epicarpurus Timorensis*, Dcne., which scarcely differs as a species, unless characters not alluded to in the description and figure can be derived from the specimens, and a Ceylon species, from Mr. Thwaites, lately submitted to my inspection, in which the perianth of the female flower does not seem to enlarge with and at length conceal the fruit, in that respect resembling more the genuine *Epicarpurus*, while the foliage and fruit are those of the spurious group. All these have the female flowers solitary or nearly so, and the males in globular heads or very short nearly globular racemes; but if there be no mistake in Blume's work, his *Trophis spinosa* has the flowers spicate (at least his generic character indicates this), and his short description of *Urtica spinosa* seems to indicate the same structure.

Epicarpurus microphyllus, Raoul in Ann. Sc. Nat. ser. 3. vol. ii. p. 117, and Choix de Pl. Nouv. Zèlande, p. 14. t. 8, has the male flowers in bracteated spikes or rather catkins, and the female as in *Epicarpurus orientalis*, but the embryo is described "cotyledonibus conduplicatis *æqualibus* plicatis foliaceis." Raoul adds, "Notre *Epicarpurus microphyllus* appartient bien au genre où je l'ai classé par forme de ses cotylédons: les *Trophis* ont les cotylédons charnus et trés inégaux, tandis que dans la plante qui nous occupe ils sont chiffonnés et foliacés." Were the only difference between *Trophis*

and *Epicarpurus* to consist in the proportion of the cotyledons, I fear that they must be again united: in *Epicarpurus* the cotyledons are often thick, but they are constantly folded and crumpled. Of the *Trophis Americana*,* which is the type of the genus *Trophis*, I have not examined the seed, nor does M. Trecul (Ann. Sc. Nat. ser. 3. vol. viii. p. 147) describe it; but there are abundant marks of distinction in the spicate inflorescence and tubular perianth.

Trophis and *Epicarpurus* both belong to the *Moreæ* as characterized by Trecul, the stamens being inflexed during æstivation.

In Trecul's memoir alluded to, an error occurs as to *Trophis spinosa*, Roxb. This I have said is one of the thorny species of *Epicarpurus*, and almost identical with *E. Timorensis* of Decaisne, as every one must acknowledge who reads attentively Roxburgh's description (Flor. Ind. vol. iii. p. 762); but Trecul refers it (p. 123) to *Cudrania Javanensis*, a plant belonging to his *Artocarpeæ*, having the female flowers in dense capitula, arranged in umbels, and with a simple style. In this he has been, perhaps, misled by Blume, who, in his 'Bijdragen,' p. 489, appears to have described a species of *Cudrania* (probably *C. obovata*, Trec.) under the name of *Trophis spinosa*, Roxb. Indeed Roxburgh himself may have led others astray, the plant to which he gave the manuscript name of *Trophis spinosa* at an early period of his botanical career, and under which he deposited a drawing in the E. I. C. Museum (tab. 119), and which name was adopted by Willdenow, never having been published by him as such: in fact, his manuscript *T. spinosa*, and consequently the *T. spinosa* of Willd. Sp. Pl. vol. iv. p. 735, is the *Batis spinosa* of the 'Flora Indica' (vol. iii. p. 762); nor is *T. aculeata*, Roth, Sp. Nov. p. 368, at all distinct: this, although belonging to the *Moreæ*, has the habit of *Cudrania*, and is the *Plecospermum spinosum*, Trec. (l. c. p. 124). So far as I can ascertain, the *Cudrania Javanensis*, Trec., was unknown to Roxburgh, although

* *Trophis Ramon* from Mexico (Linnæa, vol. vi. p. 357) is scarcely distinct. The specific name, too, is unfortunate, being obviously the same as *Ramoon*, by which *T. Americana* is known in Jamaica. *Ramon* is a Spanish expression for small boughs or twigs, which, when broken off, are suitable as fodder for cattle, and it does not indicate the species of plant.

I feel satisfied that the other species placed by Roxburgh in *Batis* (*B. fruticosa*) is referable to *Cudrania.*

M. Trecul states that the specimens received by M. Delessert, and at the Paris Museum, from Dr. Wallich, under No. 4641 of his list, belong to two different genera; M. Trecul adds however, that these specimens were from Nepal. Now herein, I believe, is some error; for, although *Cudrania Javanensis* be found in Nepal, I have reason to suppose that *Plecospermum* is not, and consequently that there must have been some mixture of labels; indeed, from the rapidity with which Dr. Wallich distributed the large collection under his charge, he could not overlook every specimen, but was obliged to leave much to those friends who assisted him. As M. Trecul does not state the *letter* attached to the specimens, I have no means of checking the error, but shall here state in detail the result of my own examination of most of the suite of specimens reserved for the India House, and now belonging to the Linnean Society of London.

4641 A, Herb. Heyne, from the Peninsula, is *Plecospermum spinosum*, with some specimens accidentally mixed of *Pisonia aculeata.**

B, from Nepal, appears to be *Cudrania Javanensis*, but the specimens are bad; this species, however, is to be seen in various herbaria from Nepal, collected by Dr. Wallich, in 1822.

C, Rohilcund. (On this I have no notes.)

D, from the Hort. Bot. Calc., is *Cudrania Javanensis*, with one piece of *Plecospermum spinosum.* The former was introduced from Nepal into the garden by Dr. Wallich, and the latter from Coromandel by Dr. Roxburgh, in 1802; consequently both, being cultivated there, may have got mixed by those who dried them; but it rather appears to me that

* In the Linnæan herbarium are two specimens, one marked by Linnæus *P. aculeata*, the other, with smaller leaves, is unnamed by him but marked by Sir J. E. Smith *P. mitis*, L. This last agrees with the specimen mixed with Wall. L. 4641 A, but not with Linnæus's description of *P. mitis*, of which, however, he had no specimen.

the specimens of *Plecospermum* belonged to the letter E, from which packet they had dropped out, and that they were not derived from the garden at all; at the same time I may state that in some herbaria specimens of *Plecospermum* only are to be found under the letter D: it is readily recognized by the paler, almost livid and obovate leaves.

E, from the Peninsula (Herb. Wight), is *Plecospermum spinosum*.

F, from Taondong. On this I have no notes; but if my recollection be correct, both C and F are species of *Cudrania*.

I may here add that of Wallich's List,

No. 4642, or *Trophis Heyneana*, is *T. spinosa*, Roxb. Fl. Ind., or *T. taxoides*, Heyne and Roth, and is therefore a species of *Epicarpurus*.

4643 A, or *Batis fruticosa*, is *Batis fruticosa*, Roxb., but is a species of *Cudrania*.

B seems somewhat different.

Morus? scandens, Wall. L. n. 4652, is the same as *M. Javanica*, Blume, Bijdr. p. 488, and *Trophis scandens*, Hook. et Arn. Bot. Beech. Voy. p. 214, and is a species of *Malaisia*, a genus of *Moreæ*, closely allied to *Trophis*, but perhaps sufficiently distinct by the number of stamens.

To sum up these remarks:—*Trophis spinosa*, Roxb. Fl. Ind. (and the only plant intended by him under this name in his published works), is an *Epicarpurus*. *T. spinosa*, Roxb. MSS., and of his earlier collections, as well as of Willdenow, or *Batis spinosa*, Roxb. Fl. Ind., is *Plecospermum spinosum* of Trecul, to which also *T. aculeata* of Roth must be referred, which is truly a Coromandel plant, and not from Nepal. *T. spinosa*, Wall., from Nepal, is *Cudrania Javanica;* to which genus *Batis fruticosa*, Roxb., and several species from the islands to the east of India, belong.

I have only to add that in the fifteenth volume of the Linnæa, Spanoghe, in his Catalogue of Timor plants, enumerates, at p. 355, " *Trophis spinosa*, Roxb.," and " *T. coccinea*, Zp.:" notwithstanding

that he strangely refers these to the *Thymeleaceæ*, leaving doubts even as to their affinities, I am inclined to think that both are species of *Cudrania*, and probably both described by Trecul.

DOONA ZEYLANICA, *Thw.*

Nat. Ord. DIPTEROCARPEÆ.

CHAR. GEN.—DOONA, nobis.—*Arbor* ingens, resinifera, versus apicem ramosissima. *Folia* alterna, stipulata, vernatione conduplicata, nec plicata; *stipulis* binis deciduis. *Calyx* persistens, 5-partitus, in æstivatione contortus; *sepalis* duobus interioribus minimis, tribus exterioribus majoribus crescentibusque. *Corolla* 5-petala; *petalis* ad basin connatis. *Stamina* 16, bi-seriata; *filamentis* dilatatis ad medium connatis; *antheris* subquadratis introrsis, longitudinaliter dehiscentibus, singula claviculo dorsali instructa. *Ovarium* superum, 3-loculare, loculis 2-spermis; *ovulis* semianatropis pendentibus. *Stylus* simplex, curvatus. *Stigma* simplex. Inflorescentia *ad apices ramorum, paniculata; paniculis axillaribus terminalibusque.*

Doona *Zeylanica.*

A *tree*, sixty feet in height and upwards, with a single *trunk*, much branched towards the upper part. *Bark* rough and cracked. *Branches* terete, smooth. *Leaves* petiolated, flat, penniveined with very numerous intermediate reticulations, lanceolate, 2-2½ inches long and ¾ of an inch wide, dark green above, paler beneath, rounded at the base, tapering towards the apex into a rather long acumen with an abrupt point. *Petioles* ½ an inch in length, grooved along the upper surface. *Branches* of the panicles pale, jointed, with small brown deciduous *bracts*. *Calyx* pale green, tinged with red, the three enlarged leaves becoming of a deeper red colour. *Petals* pale rose-colour, darker at the tips. *Stamens* with white dilated *filaments*, which are united more than half-way up. *Anthers* yellow, with a dark red dorsal claviculus. *Ovary*, *style*, and *stigma* pale green

This fine forest-tree is very abundant in some parts of the Central Province of Ceylon, especially on the crests of the hills; the

timber is much esteemed for building purposes, and the resin which exudes in considerable quantity from any wounded part of the tree is sometimes used by the natives for burning in their houses, being first mixed with the husks of paddy. The resin is soluble in spirits of wine or turpentine, and makes an excellent varnish.

The tree is called by the Cinghalese " *Doon*," or *Doon-gaba;* anglicè, *Doon* or *Doon-tree;* whence our generic name *Doona.* (The genus is nearly allied to *Hopeaa.*—ED.)—*Kew Misc. vol. IV. p.* 1.

In a subsequent volume, the following character of the embryo is added:

Embryo Cotyledonibus, foliaceis, valde inequalibus; harum maxima inter stratum oleoso-albumenosum contorto-convoluto, in germinatione inclusa; altera brevissima, in germinatione sæpissime emergente.

This shows the genus *Doona*, Thw. to be very distinct from *Hopea*, Rox. t., the Cotyledons of which, like those of *Vatica*, L. are subequal, very fleshy, and emergent in germination.

Seven species of *Doona* have now been detected in Ceylon.—*Ibid*, viii. 377.

Observations on Free Labour Cotton of Honduras and Yucatan, in the West Indies, and of Western Africa, and Natal; also, Relative to East Indian, and Slave Grown Cotton of the United States, by JAMES BANKS, *late of Honduras.*

Extracted from the "TRANSACTIONS of the SOCIETY of ARTS," for 1847-8.

My friend Dr. JAMES THOMPSON, having submitted to the Society a sample of the common indigenous Cotton of Yucatan, on the Gulph of Mexico, and of the fine Anguella sort from British Honduras, for the purpose of showing the valuable qualities that might be obtained from these quarters by free labour, I was induced to present several samples, collected by me in that Settlement; and, at the suggestion of your Committee, the following observations are thrown together:—

The importance of our Cotton Manufactures; the successful

competition of the American white and gray fabrics with those of Britain in foreign markets; the great production of the raw material by slave labour in the States; the general inferiority of that imported from India; the practicabilty of obtaining larger supplies by free labour from other quarters within our reach; the improvement of the staple and consequently of the fabric; and the opening of new markets in Africa and elsewhere, will be the subject of the few accompanying remarks, but which deserve more attention than the writer has been able to devote to them.

AMERICAN COTTON, QUANTITIES, VALUES.

The Honorable Levi Woodbury, Secretary of the United States Treasury, and Speaker of the House of Representatives, in a letter on the cultivation and foreign trade of Cotton, states that:—

The Cotton crop of the United States in 1835 was estimated at 480,000,000lbs. weight; which, computing 300lbs. to the acre, would give 1,600,000 of acres, and at 250lbs. per acre, 1,920,000 acres cultivated for Cotton.

Value of land 2,000,000 acres at 20 dollars per acre, about £4 Sterling, is 40,000,000 dollars, or about £8,000,000 Sterling.

340,000 field hands, (that is slaves) supposed to be employed, estimated then at 800 dollars each is 272,000,000 dollars, being £54,400,000 Sterling; also 340,000 assistants, estimated at half-price.

Total capital invested in theUnitedStates, in the production of cotton, estimated at 800,000,000 dollars, being £160,000,000 sterling.*

The quantity in the year 1834-5, was 1,254,000 bales, of about 350 to 400 lbs. each, in 1842-3 it was nearly double, or 2,378,000 bales;† so that the total investment in the cultivation of slave grown Cotton in the States will be now nearly £300,000,000 Sterling.

Of the unfortunate system of slavery, which Britain left in her former American plantations, the principal supports are Cotton, Tobacco, and Rice. Out of 113,000,000 dollars of domestic ex-

* See Tables and Extracts from said Letter in American Almanac for 1837, page 93.

† Cotton crop of United States for 1843.

ports in the year 1840, the then value of cotton was 63,000,000 dollars: being £12,600,000 Sterling.

Tobacco, 9 to 10,000,000 dollars ; being £2,000,000 Sterling.

Rice under 3,000,000 dollars ;* being £400,000 Sterling.

Of above 2,000,000 bales of American Cotton exported in 1842-3, Britain took nearly 1,500,000 bales ; France below 350,000 bales ; other foreign countries less than 200,000 bales. Of the growth of that year, which was 2,378,000 bales, the American manufacturers consumed 325,000 bales, or nearly as much as was exported to France. Of Tobacco,† Great Britain and the Colonies took one-third in quantity, but nearly one-half in value, in the year 1835 ; so that England may be said to employ three-fourths of the American slaves engaged in planting Cotton and half to a third of those who cultivate Tobacco for export. It becomes therefore, a national obligation on our part, to study every means by which those products may be obtained by fairly paid labour.

Our supposed dependance on the " Great Staple" of America is thus expressed in the *Times*, (30th Oct., 1845,) in an article from the Washington Union—of which the following is an extract " The " English experiment in the East has signally failed. It was made " under the most favourable auspices in different parts of India. " It has succeeded in none of them. It was made under the eye " of ten experienced planters from the cotton regions of the United " States with the best American cotton-seed ; but it has failed ! " Nature forbids any serious competition between the cotton of the " East Indies and that of the United States. The Southern portion " of our country stands unrivalled in the production of a staple " which constitutes the basis of the most important manufacture " both in Great Britain and on the continent. Britain would have " attempted to make herself independent of the United States, " throwing her own manufactures into Texas, upon terms that

* "Exports of United States, produce for 1840"—American Almanac for 1842, page 118-9.

† Made up from Table of Tobacco Exports, in American Almanac 1838, page 125.

" would have defied the competition of our own fabrics; and re-" ceiving the raw material in return, upon better terms than she " could have obtained the growth of our own Southern cotton " lands. The ACQUISITION of Texas, therefore, makes her greatest " interest (the most important branch of her manufacturing system) " dependent upon us. In the same proportion, of course, it gives " us every advantage in competition with her. The ACQUISITION " of Texas thus puts us in possession of almost all the best lands " in the world for the growth of cotton; and this is decidedly one " of the most important staples, in every respect, than can be cul-" tivated by man. If we do not hold the monopoly of the article, " yet we produce it of better quality, and in greater quantity, than " any other country. Thus it becomes an unfailing source of " wealth and abundance—of prosperity in peace, and of power in " war." This assertion brought several communications to the *Times*, and *Manchester Guardian*;* from which it appeared that, though the American seed had generally failed, from excessive drought or neglect of local irrigation, yet it had succeeded in several districts, especially at Dharwar; was progressing among the natives; that the American Saw Gin had been advantageously applied, giving all the benefit of celerity, cleanness, and superior

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* London *Times*, 30th Oct., 6th and 10th Nov., and 26th Dec. 1845. *Manchester Guardian* of the 27th Aug., 8th Nov., and 6th Dec. 1845. The *Manchester Guardian* of the 1st Jan. 1842, and following, has a valuable letter from the Chamber of Commerce at Bombay, on improving Cotton cultivation of India.

⁎ Since the above communication was made to the Society of Arts, much valuable information has appeared in the Public prints, &c.

Besides the Parliamentary Report of 1848 on the Growth of Cotton in India, two articles in the Manchester Guardian of 5th June, 1847 from the "*Bombay Telegraph*," and the "*Calcutta Englishman*," would show our friends of the Washington Union that supplies of free grown Cotton from American Seed are far from a hopeless attempt. If restrictions on Land, and internal commerce are removed in the forthcoming renewal of the East India Company's Charter; the progressive opening of Railways through the three Presidencies, may persuade our transatlantic customers that successful competition in Cotton will be soon maintained by Free Labour; and Great Britain is morally and pecuniarly interested to encourage the United States by every fair compensation to a like attempt.

quality; and so much had the native manufacturers preferred it that little had reached Lancashire.

A deputation from the Manchester Commercial Association having waited on the Directors of the East India Company, 5,000 bales of the best and cleanest cotton from American Seed were to be purchased, and shipped to this country, that English Spinners might have an opportunity of testing its qualities, in comparison with American Growth.

Thus has the American Saw Gin been advantageously applied in India; and it may also be applied in Tropical Africa, where indigenous cotton exists;—or wherever a favourable climate admits of the seed being cultivated; for it is upon the power, continuous motion, and expedition of the Saw Gin, accompanied by the Screw Press for baleing it, that free labour must depend for success; and, where the more productive climate of the Tropics affords so much larger returns than more temperate regions, there is every reason to expect successful competition with slave labour.

ROLLER AND SAW GINS.

A short explanation of the Roller and Saw Gins may enable their application to be better understood. The Roller Gin, commonly used in India, consists of two pieces of round hard wood, about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in diameter, fixed horizontally into an upright frame, and turned by an endless screw, or oblique cogs, by means of a crank-handle; so that any cotton presented between the two rollers is drawn through, and the seed not being able to pass, flies off. It so happens, however that the cotton of one seed gets entangled with that of another, especially if small, (as some of that of India is), whereby some seeds get pulled through, mixing with the wool, and staining it from the oil crushed out by the pressure. This process is slow, and drags much of the dirt of the field along with it; though it is supposed to hurt the staple less than the Saw Gin. A model of this Roller Gin may be seen in the East India Company's Museum, among those of oriental implements. When seeds are covered with a thick down, the process is too slow to allow even fine cotton to be freed from the seed by

the Roller Gin: and till Whitney's Saw Gin was invented many fine and long stapled but downy seed-cottons were abandoned by planters.

The Saw Gin consists of a number of circular blades of iron, with teeth of about $\frac{1}{8}$th to $\frac{1}{4}$th of an inch long set round a wooden cylinder, at about $\frac{3}{8}$ths of an inch distant from each other;—the cylinder in the HAND Saw Gin is moved by a small wheel and pinion: the Saws just pass so far between the bars of an iron grating, against which the cotton-seed rests, as to catch hold of the wool and pull it through the bars, leaving the seeds to revolve till completely cleaned.

The cotton is swept from the Saws by a revolving fanner; on each arm of which a line of hair brushes is fixed, or any other substance, (such as Spanish broom) that will effectually remove the cotton before it can be again carried through the grating. When these brushes are neglected the cotton gets cut, and its long staple injured; they should, therefore, be often examined and replenished. The cleaner, lighter, and longer stapled cotton is blown to the distance of some yards behind the Gin, if there is space; the heavier and most dirty falling immediately at the back of it. Thus two qualities may be obtained from the same cotton, at the same time. The fanner above mentioned is kept in motion by means of a band and pullies, connecting it with the wooden cylinder. By the Saw Gin any seeds, however difficult to clean by the Roller Gin, are swept clear of almost all the cotton on them; and its operation is so expeditious, that while a man will not pick more than 2lbs. of wool per day by the hand,—by a small Saw Gin of eighteen saws he will clean from 50 to 70lbs. The same Gin, driven by steam, or other power, will clean 300lbs. per day.

The Roller Gin, propelled by the foot, like a turning lathe, and used in Demerara, formerly required the labour of seven days turning, besides six persons cleaning, to obtain 300lbs. Dutch weight; thus giving only 23lbs. per man, and with very hard work. By the aid of cattle, a saving of eight or nine days labour was effected and with very easy work for the people employed; four well grown cattle being sufficient to furnish from 900 to 1000lbs. per day

The Roller Gin is still used for finer Sea Island Cotton, which would be injured by the Saw Gin. I am told, that the Saw Gin has been improved by a mechanic in the service of the East India Company, from whom he has received a pecuniary acknowledgment for the improvement. An American gentleman, now in this country, has patented a different mode of cleaning, with all the celerity of the Saw Gin, without injuring the staple; not only removing the seeds, but even the small motes which weaken the thread and render the web rough and irregular.

SCREW PRESS.

The other essential Implement to enable African or other Cotton to compete with American is the Screw-Press. By compressing the wool into a compact and square, instead of a bulky and round bale, it can be brought at a freight of one farthing to one half-penny per lb. which, otherwise, could not be shipped here under one penny or three half-pence per lb.

The cotton is thrown into a square box, and by means of a screw it is pressed upwards against a beam, where the compactness of the bale is secured by ropes previously arranged.

CLEANING COTTON FROM DIFFERENT KINDS OF SEED.

It is of importance to attend to the seeds being covered with a thick down, or comparatively bare, and free from down. When they are covered with a close adhesive down, however fine may be the staple of the surrounding Cotton, the seeds are so difficult to clean by the best Roller Gins as to make the article unremunerative; when the fine sorts are cleaned by the Saw Gin, they may be torn and so reduced to the better qualities of New Orleans or Egyptian, worth from 6*d.* to 8*d.* per lb.

If the seed is of the fine stapled sort, and bare of down, then the Roller Gin may be employed, as injuring the fibre less than the Saw Gin; of this kind is the American Sea Island, which, when so cleaned, brings 12*d.* to 18*d.* per lb. The Anguilla and some of the indigenous sorts of British Honduras, comparatively bare of down, could be advantageously cleaned by the Roller Gin, and are considered to resemble Sea Island. Hand picked samples

have been valued from 10*d.* to 15*d.* and 18*d.* per lb., and Anguilla, from 18*d.* to 2*s.* per lb. The clustered seed of Honduras, (supposed the Kidney seed of Brazil,) is a strong and long stapled cotton, but not fine ; the seed is almost bare, is very easily cleaned by the Saw Gin, and, from its adhering together instead of being in detached seeds, is easily picked from the tree, getting less mixed with the Cotton leaves, which prove a detriment to the East India Cotton. The Kidney sort is remarkably hardy in the Tropics, and grows every where, whether near the sea or far inland. The writer had some of both these Honduras sorts cleaned by the Saw Gin, and sold by Messrs. Ewing and Co., of Glasgow, in 1841. It was disposed of at 6*d.* per lb., in order to get its spinning quality tested. The Kidney, and some stained Sea Island were reported as adapted for mixing with ordinary quality of Orleans Cotton for No. 60 to No. 64 weft; the other native Honduras seed, of a finer fibre, but also Saw Ginned, was considered fit for mixing with fair American Bowed, or Orleans for No. 70 to 80 weft: the value of the first on trial was stated at $6\frac{1}{4}$*d.* and of the latter at $6\frac{3}{4}$*d.* per lb.; or at one farthing, and three farthings more per lb. on trial than was paid for it; these prices being then equal to, or better than those of the best New Orleans. From a little of the Anguilla, grown in Honduras, it seemed to thrive near the sea, and was reported from hand picked samples, to be fit for making the finest Nottingham Lace. It was the original of the American Sea Island, having been sent from the West Indies by some Royalist Emigrants to their Republican friends after the American Revolution.* Though still of a fine sort, this kind has evidently become coarser, and the seed larger than the parent Anguilla. The Anguilla is entirely bare of down, and would be easily cleaned by the Roller Gin. It, however, yields only $17\frac{1}{2}$ per cent. of wool from the Seed Cotton; while other kinds give about 25 per cent. of their weight shortly after being collected, but more as the seed becomes dry.

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* Tropical Agriculturist Article "Cotton," pages 36 to 38, which details some interesting facts regarding the gift of Sea Island Cotton to the American planters.

QUANTITY PER ACRE.

The American Cotton was estimated by the Hon. Levi Woodbury at 250 to 300 lbs. per acre in 1835; since then, its cultivation having extended to Alabama and southward, the returns of those States are 400 lbs. per acre and upwards, in consequence of their finer climate and longer summer; in all probability, that of Texas averages still more.

The Cotton Plant, which in Carolina is an annual, being killed yearly by the frost, rising only to a spread and height of eighteen inches becomes a perennial, of from five to six feet in height and spread in warmer climates. If we may rely on an experiment made on ten acres in Jamaica, the American Sea Island seed gave a return of 500 lbs. of wool per acre, (corresponding with that in Demerara); and was expected to yield at two crops per annum 1,000 lbs. per acre,* the wet season however is less favourable to the opening of the pods, the regularity of the picking and the dry quality of the Cotton; but the same description of Cotton in Carolina gives only 150 to 180 lbs. per acre.

The expectation from crops in India is only 300 lbs. per acre, or at most 300 to 500 lbs. of Wool from American seed. The native seed is said to yield far less; and that exported is of an inferior sort. The East India seed which I have seen is small, and would easily pass through between the rollers, and having a close adhesive tuft is the more difficult to clean unless by the saw gin. Both causes may possibly be owing to a want of change of seed, or a rotation of crops; the neglect of which is ascribed as causing the abandonment of its cultivation in the West Indies, when it began to spread in America.

AMERICAN AND ENGLISH FABRICS.

The American White and Gray Cottons are now maintaining a successful rivalry with British manufactures in foreign markets. Their unbleached domestics, as also their white calicoes, command a higher price, from their superior strength and durability, than

* Statement by H. Gourgues to the Assembly of Jamaica.

English goods.* While the American manufacturer saves the difference of freight, he buys a superior article, and gives ½ a cent. to 1 cent. more per lb. (¼d. and ½d.) than for shipping qualities sent to England.

The English manufactures for foreign markets are composed greatly of East India Cotton, which is shorter and weaker, though possibly finer, than American; it is also greatly mixed with particles of brown leaves and motes, which, notwithstanding all preparatory processes, get spun into the thread and weaken its adhesion; and though they are removed in the dressing of white cloths, they yet leave the web less entwined throughout: the leaves and motes are occasioned by neglect of picking the Seed-Cotton from the pods as they successively open.

The fibre of Cotton,† viewed through a microscope, is described as having a range of hooks on its edges, by which one fibre adheres to another. On this account it is said to be less fit for surgical purposes than flax; the fibre of which is found to be a succession of smooth hollow joints. Where these serrated edges are less perfect the thread will be weakened, and to prevent their breaking, the English Fabrics require a slower operation, especially when mixed with East India Cotton.

It is said by an English operative, who counted the strokes with his watch in his hand, that the American spinner, having paid from 5 to 10 per cent. higher for his selected wool, gains 20 per cent. by the rapidity of his machinery; as, when weaving for a foreign market, he can give 130 strokes at the loom per minute, instead of 100 to 110. On this point, however, I only repeat the information received. The American manufacturer has likewise, in different portions of the States, a great command of water-power, and in selecting new situations, in such an unoccupied country,

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* In the year 1831 the export of American manufactures was £220,000 sterling. —*American Almanac for* 1833, *page* 126. In 1841, it was £600,000 sterling, chiefly of white cottons.—*Ditto for* 1843, *page* 191. In 1847, the value exported was £816,500; and in 1848, it reached £1,143,600 sterling.—*Ditto for* 1850, *page* 176.

† Baines' History of the Cotton Manufactures of Britain.

they allow no grog shops in their neighbourhood, they having found that the expense of maintaining the paupers thereby created, costs them more than each State gains by the sale of licenses to publicans ; thus they save the strength, time, and continuous labour of their workmen. Generally in their other manufactories, the workmen breakfast at seven in the morning, before commencing work, and are reckoned to save from fifteen to twenty minutes, which otherwise would be lost in recommencing and collecting their tools, &c &c.

EAST INDIA COTTON.

Having mentioned the broken leaves mixed among the Indian Cotton, let us now refer to the cause. The pod of Cotton consists of three divisions, which on becoming ripe, open and separate from each other under the influence of a hot sun, allowing their contents to drop either more or less out, and to become exposed to wind and weather. Three fine leaves surround the pod, which soon become brown and dry, and get mixed with the Cotton when left neglected on the tree ; so as to render it very difficult to remove the Cotton seed without breaking these dry and get mixed with the Cotton when left neglected on the tree ; so as to render it very difficult to remove the Cotton Seed without breaking these dry leaves, and intermixing them with the wool. But, if the Seed Cotton is removed as the pods successively open, these three leaves are then tough and yellow, and allow it to be picked out entire and unbroken. The smaller fingers of women and children are found more nimble and better adapted than the larger fingers of men, for picking out these three clusters of Seed Cotton without breaking the leaves. The common East India Cotton seems to be left long exposed, and comes home mixed with leaves, twigs and sand : the refuse, when the whole is put through the saw gin, being one-fourth of the quantity brought from the field ; whereas at Manchester, the waste on American does not exceed 10 per cent. This neglect is ascribed to the number of Hindoo holidays, the control of country bankers over the growers, and the apprehension of a higher annual land-tax being exacted by the East India Company should they produce a better article.

It is replied that the Hindoos would work, notwithstanding holidays, were they liberally encouraged by resident Englishmen up the country, instead of being under native agents, who most probably sell the best Cotton to weavers on the spot, and only forward the less saleable to the coast. As the Company cannot now engage in commercial speculations, the tenure of their charter induces every encouragement to speedy local improvements. It appears that the ultimate buyers, residing entirely on the coast, have nothing to do with its production or transport, and purchase it only as an article of speculation or remittance ; so that the exporter has no direct interest in its original improvement. In quality the Indian wool compares most nearly with the finest American, and could its staple be a little improved, would rival it in the British market. "It is likewise distinguished," observes Dr. Royle, "from the American short-stapled cottons for some good qualities. The first of these is colour, by which yarn and cloth in which it is employed are much improved in appearance. The second is the swelling of its thread, which, when the cloth is bleached enables the intermediate vacancies to be filled up, giving the whole a more substantial appearance. The third good quality is that in dyeing it takes the colour more uniformly than other Cottons. The best quality of the Bombay Cottons are those from Broach and Surat, which in good seasons, are found to be equal to middling-bowed Georgia. With respect to long-stapled Cottons, the presumption is that they can be grown in India of an equally fine texture with those of America."

The improved East India Cotton will probably, for some time to come, be bought up and manufactured on the spot, as but little of it has yet reached England, and must on its arrival compete with American. A large proportion of it is likely to find a better market in China. The averages of five years up to 1841-2 give only 66,000,000 lbs.* as exported to Britain, and 90,000,000 lbs. to China. The largest quantity obtained from India is but one-sixth of our consumption, and of this above one-third appears to be re-exported from London.

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* Anti-Slavery Reporter for October 1845, page 182.

AFRICAN COTTON.

Considering therefore the general quality and limited supply yet received from India by free labour, the whole sea coast of Africa presents a large, cheap, and more contiguous field for the wants of England; while it offers an extensive market for our manufactured goods. Park and almost all African discoverers speak of markets for the sale of native cloths, made of their indigenous Cotton; but the separation of the raw material from the seed must occasion them much trouble and loss of time. So far as I can learn, the process is very rude, and by hand picking is very tedious. The saw gin moved by the hand will become the means of supplying their own wants first, and thereafter of increasing exportation; the screw-press packing it into square bales for shipment. The original mode of packing, still practised, was for a man to stand inside of a large round bag and press it down with his feet. St. Domingo Cotton is still liable to this objection, and is thereby exposed to a double or triple freight.

The question is does Cotton abound on the coast of Africa? From the reports of Missionaries and of gentlemen who visited the Niger it appears to be plentiful; and they are the men who by acquiring the esteem of the Natives, rendering them teachable (as in many instances they have), and residing among them, are the most likely to introduce both the saw gin and screw-press. Of cotton cultivation the natives most likely know more than Europeans.

I understand, from the Secretaries of the Wesleyan and Baptist Missionary Societies, that the missionaries of those societies have not only their sanction, but their instructions, to promote such objects among the Natives at their several stations, as a means of enabling the Natives to support their missons, and of drawing the aborigines within reach of teachers. We find these Missionary establishments all along the coast of Western tropical Africa;—and to the former has now been added the Scotch; or rather Jamaica establishment, at Old Calabar, near to Fernando Po.

The cost of a common eighteen saw gin, moved by a wheel and pinion and crank-handle, is about £25 to £30. Larger and more

powerful would follow, and could be driven by oxen by means of simple gear; a forty saw gin with a screw-press is used in Virginia to clean the crops of the neighbouring farmers at a per-centage on the quantity ginned.

The advantage gained in Tropical Africa consists in the much larger return, from the same extent of surface, than the colder climate of the States can average. I have generally found a tree yield upwards of eight ounces of wool at one bearing, on a space of five feet square; which, at two crops per annum, would thus produce 800 lbs. per acre, or double that obtained from the Southern States by slave labour.

In regard to experienced labourers for Africa, it is a gratifying fact that many of the planters in Maryland and Virginia would emancipate their slaves, provided they could be sent out of the country so as to save them the expense of supporting them, which the laws of these States make imperative on setting them free. In proof of this disposition, the Government of St. Domingo was at the charge, about twenty years ago, of conveying 13,000 Negroes from the Slave States to that Island, where they were located as free men. It is, in all probability, through them that the saw gin has been introduced for Cotton; the screw-press being still required on the coast, previous to its shipment.

Natal, near the Cape of Good Hope, is now obtaining the attention of English colonists, as an extensive field and favorable climate for Cotton. Having furnished some Honduras seeds to a gentleman connected with the Cape, a communication which accompanied them was printed in the Graham Town Journal, of 10th July 1845; embracing, more in practical detail, several of these and other points relative to its cultivation. I am informed that some bales of Cotton have already been sent from Natal, and tropical Africa should not be less productive. Among the samples produced is a little brought from the Niger, of a strong useful quality; also two spindles of native made thread, and a piece of cloth from Dahomi in Ashanti, woven in narrow strips of about three inches broad and sewed together. It is dyed in different

shades, with African indigo; for which dye I am told each village has its dye-pit; all indicating the extent of Cotton cultivation in Africa. But we must enable them to present the raw material in a merchantable condition, by the preparatory process of ginning and baleing, that they may be able to give us value in return for Manchester and Glasgow manufactures. Among the communications to the *Times** is one on the Culture of Cotton, signed "An African traveller," which states—"That in the reign of Queen Elizabeth, Europe derived all her supplies of Cotton from the "west coast of Africa. Unfortunately, the slave trade offered "greater commercial advantages, and the produce of that continent "became neglected. Should it be so, when in one generation, by "the evidence of the American Cotton trade itself, England could "raise in Africa a source of supply, the quality of which should far "surpass even the boasted fineness of the South Sea Island Cot-"ton? From my knowledge of the continent of Africa, I can prove "that her spices, her indigo, her cotton, her coffee, her saltpetre, "her copper, her ivory, her quicksilver, and her gold could be put "into European markets at one-third the price of the similar pro-"ducts either of India or America. The ancient Phœnicians were "not the carriers, as has been long supposed, but the actual pro-"ducers of the riches and luxuries with which they supplied the "inhabitants of Europe; and it is their empire which the French "are attempting to establish again in Africa."

SAMPLES PRODUCED.

Among the samples exhibited to the meeting of the Society were the following—From Honduras, the clustered or kidney seed, showing its form and staple, which was sold at 6*d.* and valued on trial in 1841 at 6¼*d.*; also its native Cotton, resembling Sea-Island, which when saw-ginned, was valued at 6¾*d.*: the seed of it is almost entirely free from down, and therefore capable of passing easily the roller gin, and bringing a much higher price.

A specimen of the Anguilla, grown in British Honduras, is one of the very finest Cottons known. Its seed is entirely free from

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* *Times*, 10th November, 1845.

down, easily separated, and therefore readily cleaned by the roller; its seed was the smallest among the samples. There are other kinds (indigenous to Honduras), which are fine, but covered with down; rendering them difficult to clean except by the saw process; one kind is of a grey colour; another is red, furnishing the cream coloured Cotton.

From other quarters there were produced a sample of Sea Island, as grown in Jamaica from American seed; it was saw ginned. Also a small sample of the same hand-picked, for the sake of comparing the fibres of each. Its seed is, like that of its parent, the Anguilla, quite bare, and therefore easily ginned by either process. It is the Sea Island, from American seed, that is now grown in Egypt, and generally quoted at 7*d.* to 9*d.* for saw ginned sorts. Some of the common leafy Cotton of India, as it came to England contrasted with a specimen of improved Madras sort. In order to show how the leaves get intermixed with the Seed Cotton, there were shown two pods, as taken from the tree, when neglected and exposed to the weather. These pods were from Jamaica; the wool fine, and the seed as bare as Sea Island or Anguilla; thus proving that we have various fine qualities capable of being rendered remunerative, in our own West Indian possessions, and having all the advantages of larger tropical perennial crops than can generally be got in the more temperate latitudes of the American States. How far it will be profitable to grow these, will depend chiefly on the greater productiveness per acre, in or near the Tropics, and the saving of time and hands on perennial compared with annual crops, especially under a more improved system than was formerly practised. There is some valuable practical information in the forty-seventh volume of the Transactions of this Society from a Planter in Demarara;—page 178.

As compared with other tropical products, it must be remembered that coffee takes from three to five years before any returns can be expected; and that the introduction of sugar making into Africa, would require an expensive apparatus at the outset, which Cotton does not, while it returns a crop in about nine months after planting.

CAPABILITIES OF HONDURAS AND YUCATAN.

In regard to the British settlement of Honduras, as a future field for cultivation, it presents an extent of sea-board of above 200 miles, by from 50 to 100 miles inland, and is nearly three times the size of Jamaica, the largest of our West India Islands, from which it lies about 700 miles due west on the mainland; it possesses a virgin soil, fine climate, several navigable rivers, and numerous means of water carriage. Would government guarantee security in its land, for the purposes of cultivation, it could afford scope for the employment of large capital; but at present it is restricted to the mere products of the forest, almost entirely to mahogany and logwood: as it is, its imports now reach above £400,000 sterling per annum, employing 22,000 to 28,000 tons of shipping.

Dr. Thompson has brought home one sort of the native Seed Cotton of Yucatan, which is among those produced; it is fine, but from its downy nature could only be cleaned by the saw gin. So extensively was this article grown in Yucatan that, in the times of the old Spanish Historians of the Conquest, the Natives came to fight against the Spaniards in defensive armour thickly padded with cotton. The Indians of that Peninsula, as described by Stevens, are familiar with the culture of cotton, of sugar along the coast of Campeachy, and of tobacco and maize in the interior. They cannot know the use of the saw gin; but an American gentleman is mentioned by Stevens* as now growing and manufacturing Cotton in the neighbourhood of Merida, for disposal in that city and vicinity.

When Dr. Thompson was in Yucatan he saw mule loads of Cotton in the seed (that is, as it came from the tree), conveyed to Valladolid and Merida, to be sold there; thus carrying 75 per cent. of unnecessary weight, by not freeing it from the seed on the farm where it was grown.

The Indians, though nominally free, are much oppressed by the Spanish descendants, and from their youth up to advanced age in a state of debt for small advances. Were political disabilities re-

* Stevens' Second Incidents of Travels in Yucatan.

moved, many of these Indian Yucatecas might be induced to settle within the limits of British Honduras, with their whole families, and cultivate cotton, rice, tobacco, and sugar with which they are already acquainted; but on which the length of this paper forbids me to enlarge at present.

The great increase of slave-grown Cotton in the States, and our dependance on it; the greater strength of their common fabrics, and their competition in foreign markets with those of Britain; the yet limited supply obtained from India, the demand for it in China, the inferiority of that generally sent, and some of the causes of that inferiority; the advantage gained by the use of the saw gin; the practicability of introducing it and the screw-press along the coast of Africa, as a new means of obtaining more tropical Cotton; the capabilities of Honduras and its samples; and the various qualities of difierent seeds, have been thus cursorily glanced at, in hope that these topics may receive more attention than it is possible to give them on the present occasion.

Since the above was written the Yucatan Indians have been more generally aroused to assert their independance; already about 4,000 have betaken themselves to the British Settlement for protection, and are engaged in growing Rice and Maize for our Shipping and Settlers. (See Honduras *Watchman* of 15th and 22nd Februry, 1851). Were the improvement of their native soil sanctioned by Her Majesty's Government, an emigration of free aboriginal labourers would soon resume the production of the Cotton and Chocolate with which they were so familiar when Cortez landed on their shores.

Grammars with Vocabularies of the Maya and Mosquito languages now afford means of communication with these tribes; the Carib has had a like service rendered to it in the Settlement, and now only waits the means of publication.

Note to page 124—Directions for Planting Cotton, and preparing it for Shipment; taken from the Graham Town Journal—For many other useful details the reader is referred to the Tropical Agriculturist by G. R. PORTER.

COTTON SEED requires a dry soil, and sandy rather than clay; it will thrive in a poor soil, but better in good earth. The ground must be of that free

open nature to allow the tap-root to penetrate without obstruction. It is better to try experiments on a small scale, as experience can be obtained at a cheap rate in the first instance which may otherwise prove very costly—such as relates to the soil for different kinds; the quantity from each tree, or from an average number or proportion per acre; the proportion of cotton to the seed; which is finest, longest, or strongest; which is most easily cleaned, or most downy and difficult, or most subject to attacks of insects; or grows best near the sea or inland.

It is an object to destroy the insects, catterpillars, &c. as soon as they appear, to prevent them depositing their eggs: for this purpose fowls and particularly turkeys are serviceable; and perhaps indigenous cotton is less subject to insects than newer kinds. A great deal depends on keeping the seed in a dry and well aired situation, and turning it over occasionally till required, removing any appearance of them, and burning refuse leaves &c. as soon as possible.

SEA ISLAND COTTON, which is an annual in the United States of only 18 inches apart, becomes a perennial in the tropics of six feet, and needs to be planted six to eight feet apart, bearing well for five or six years; and in proportion according to the temperature of the climate; giving a crop in 6 to 9 months according to the time of planting. It should be planted near the sea, and rather on a saline soil. It must be cleaned by the Roller Gin to obtain the best price—at present 1s. to 1s. 6d.—formerly 1s. 6d. to 2s. The Egyptian is said to be from Sea Island, and brings the best prices of the saw-ginned cotton, about 7d.

ANGUILLA is a very fine cotton, and the original of the Sea Island from the Bahamas; it is said to be fit for making the finest lace when carefully picked and roller-ginned, valued about 1839 at 2s. to 3s. per lb. It yields only 17½ per cent. of cotton; other kinds 23 to 25 per cent.

KIDNEY OR CLUSTERED SEED.—That of Honduras is very hardy, and grows everywhere, near the sea or far inland, yielding about 8 ounces per tree, of wool per crop, at 6 feet apart. Some kinds bear two crops. It can be picked from the tree with ease, with ordinary care, without breaking a leaf, and is easily cleaned by the saw-gin. Its value is equal to the best New Orleans, and the same machinery serves for spinning it.—In 1842 I sold it at 6d. per lb. in Liverpool and Glasgow.

DOWNY COTTONS.—When the seed is much covered with down or short hair they can only be cleaned by the Saw Gin, however fine: so that the fine sorts have their texture injured for the high priced class, and are therefore reduced to the ordinary sort. The American upland is very downy but strong, and therefore can only be cleaned by the Saw Gin. Some kinds have so little down that they can be cleaned by the Roller Gin. If the down is of red colour it makes the cotton cream coloured.

INDIGENOUS COTTON deserves attention as most likely to stand the climate, and to be less the prey of worms and flies. They improve by cultivation, and when neglected become small, covered with hair or down. They however indicate the soil on which cotton will thrive if abundant.

QUANTITY OF COTTON PER ACRE seems to vary according to climate and soil,—the Sea Island at Edesto River and St. Simonds Island, U. S., yielding 100 to 150 lbs. per acre on " Pine Barrens," or land previously unproductive. South Carolina yields 600 to 800 lbs. of seed cotton per acre of land, 150 to 200 lbs. of wool.—250 to 300 lbs. is reckoned by Levi Woodbury the average of United States' crops. The South is supposed to give 400 lbs. and upwards in Louisana, Alabama, &c. A planter in Jamaica asserted to the writer that he had 1000 lbs. per annum from Sea Island at two crops? Whatever quantity it would yield may depend on a long dry season, and hands enough to pick it as it opens. A warm climate where no frost, or little prevails, will have the advantage in saving labour, and in abundant crops. It is an object to try whether, with these advantages Free labour cannot compete with Slave labour, which with its prime cost, deaths, clothing, food, &c. costs the Americans £30 or £40 per annum.

ESSENTIAL POINTS REGARDING COTTON.—Prevent the increase of insects, particularly the cotton bug, by destroying them before their eggs are deposited, by use of lime in powder, sprinkled through a cullender on the leaves &c. —keeping them free of weeds;—turkeys and fowls are of great service.

PICKING THE TREES should be done as soon as the pods open, before the seed cotton separates from its receptacles, it is then in its most clean state and easily collected. What is *stained* should be at once (in the act of picking) put by itself, the picker having two bags, one for clean, another for stained;—or a different set of pickers following for the stained alone.

DRY POD LEAVES.—Three fine leaves surround the pod which become brown and very brittle (as the cotton is left longer on the tree); when neglected it is very difficult to pick the seed-cotton from the pod without breaking these leaves, and mixing it with the wool, but if picked as the pod opens, these three leaves are then yellow and very tough, and therefore unbroken,—so as to be got separate from the new entire seed-cotton.

WOMEN AND CHILDREN are the best seed pickers,—their small fingers getting hold of the tip of the three clusters which form the pod and pulling them out entire without touching these three leaves, and having more nimble and pliant joints save time and wages. If these dry leaves once get mixed, the Saw Gin breaks them up to atoms, and they are spun into the threads, thus forming specks which weaken and disfigure the gray cottons made from East India Wool.

POPULATION.—In order to secure plenty of hands for picking, it is desirable to have cotton plantations near towns, or where plenty of young hands can be obtained to collect the ripe cotton as it opens, ere it blows about in the weather.

GINNING.—The use of the Saw Gin by *rapid* and *powerful* means is necessary to compete with America for ordinary qualities; a common hand Saw Gin may do at the outset, but to any extent, Cattle, Water, or Steam, are necessary to get the crop to market, and save expense of wages. The common 18 Saw Gin will give about 50 to 70 lbs. of cotton wool (from 200 to 300 lbs. of seed-cotton); —the same Gin by steam will turn out 300 lbs. of wool.

SCREW PRESS can be driven by Cattle, as the cotton accumulates from the Gin, both being under one roof. The screwing of the cotton into compact bales saves heavy freight: say $\frac{1}{4}$ or $\frac{5}{8}$ (of a penny) per lb. instead of 1d. or $1\frac{1}{4}$d. It is described in the "Tropical Agriculturist."

CLASSING AND SEPARATION.—Besides clean and stained cotton, it will be found on observati n that the worst and heaviest falls immediately at the back of the Gin, containing sand, earth, and dust, while the lighter and better is thrown to some distance back:—the two should not be mixed, but packed and marked separately,—which the Ginner and packer if only hired is apt to collect all in one. When sold in Liverpool the manufacterers often obtain a deduction of 2 per cent. and upwards for sand and refuse.

FANNER AND BRUSHES.—In the Saw-Gin the brushes sweep the wool off the saws, and the arms of the fanners blow it out of the frame, to a greater or less distance. The brushes being of hair get worn out, and when this is the case the cot on is apt to be carried round a second or third time, and passing through the bars of the iron frame it gets entangled. It is therefore of importance to examine the brushes frequently, and to replace new hair. Spanish broom answers very well in place of hair. See that it touches and sweeps the teeth of the saws fully,—keep the teeth clean and free from rust and damp.

Prevent if possible the cutting of the seeds on the saws, as the oil stains the cotton. For this purpose see that the mass of seed-cotton is always presenting a fresh surface to the saws by moving round, which it will do while there is cotton on it, and full enough to pass against the saws and front of the box gently without cramming.—Saw and Roller Gins may be had at FAWCET AND CO.'s, Iron Foundry, Liverpool.

COTTON OIL.—Oil is got from the cotton-seed of America, and sent to New York for sale, whenever the seed is not so fresh for sowing. Cattle and goats are fond of the seed even three years after cleaning—but it should be singed if any wool remains upon it. To obtain the oil the seed must be first bruised, and then either pressed, or boiled with hotwater, skimmed off and evaporated. If pressed preserve the oil-cake for feeding cattle in England—where Linseed oil-cake is worth from £5 to £6 per ton.

SCIENTIFIC INTELLIGENCE.

Fall of Meteoric Stones.

On Saturday the 28th of February last, two large Meteoric Stones having fallen with considerable velocity so as to bury themselves into the earth near the village of Parnallee in the district of Madura, the Rev. Mr. H. S. Taylor, Principal of the American Mission

there, having been made acquainted with the fact, proceeded himself to examine the spot, and at the request of the villagers reported the circumstance of their fall to the Collector. The following are Extracts from his letters upon the subject:—

"Near the Village of Parnallee in this Talook two Meteoric Stones have fallen. I have been on to the ground and seen the places where they fell, and the exact impression made in the earth where they lay. As no rain has fallen since, I was able to see that there was no mistake about it. The noise made as they came through the air, made a deep impression on the minds of the people in that region, and was heard, I find from reports, along the sea shore up to Teruchooly. They fell about three miles apart from each other. The smaller one weighs about 37 pounds, and sunk in the earth when it fell two feet and eight inches. The larger one is from three to four times as large, and sunk in the earth two feet and four inches. It struck the earth flatwise. The smaller one fell about perpendicularly. The larger fell (coming from the North a little to the West) making an angle with a perpendicular line, of about fifteen degrees. Persons were standing near each place when they fell. Many worshipped them. The villagers gave them up to me on condition that I should inform you, and save them from trouble made (or rather which they feared some officials might make). I do not make this statement officially, but I am ready, if you desire it, to make an official statement on the subject. In writing this I have fulfilled my promise to the people there.

* * * * * In respect to Mr. Murray's request through you, I would state that I gave a somewhat minute account of their fall, &c. to Dr. Colebrooke with liberty to publish should he think best in the *Athenæum.** If he has done so, this may not be needed. I will however give a few particulars.

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* TO THE EDITOR OF THE ATHENÆUM.

SIR,—Some of your readers may be interested to learn that two Meteoric stones fell in the village of Parnallee in this district, and not far from Ramnad on the 28th of February and at noon. The fall was preceded by a noise which it is stated, bore an analogy to the reverberation of thunder, though it was much louder, and the stones were propelled with such force that though one of them weighed 37 pounds, and the other was four times larger, they were neither of them seen in their transit through the air, though numbers of persons were standing by at the time. They fell about 3 miles apart and both became deeply imbedded in the ground, sending up a cloud of dust when they struck. They were forwarded to Madura and are now in the Collector's Cutcherry. They bear evident appearances of having been subjected to the action of fire and are covered with a black smoke-like coating. Their formation appears to be partly granitic, with a good deal of ferruginous matter interspersed. The natives of course accounted for their presence by attributing them to the wrath of a *swamy* whom they sought to appease by worshipping them. Others held an equally extravagant hypothesis and supposed them to have been blown from a cannon at

They fell on the 28th of February, Saturday, at about noon, a little South East of the Village of Parnallee, Latitude north, according to the Government Map, 9° 14', Longitude 78° 21' East.

The largest one fell a few seconds before the smaller one, and from two to three miles North of it. As was manifest from the hole it made in the ground when it fell it came from a direction some ten degrees West of North, making an angle of about 15 or 20 degrees with a line perpendicular to the earth's surface. It struck the earth, (or at least lay in the bottom of the hole made by it) flatwise, on the side that is most convex. The most round or convex side of the smaller stone also was downward, this being the position they would naturally assume as they passed with great velocity, through the resisting atmosphere, an idea which did not occur to me till now. I had before simply noted the fact. The larger stone sank into the earth when it fell two feet and five inches in a perpendicular direction. The smaller one about two feet and eight inches. The smaller one fell also about perpendicularly. The smaller does not appear in any respect like a fragment of the larger one. The specific gravity of the smaller one when it fell was about 3·3, water being the standard of unity. I observed that the specific gravity was increased after exposure to a shower, or rather that of the smaller one was. I did not try that of the larger. The crack on the convex side of the larger one I did not perceive at all till it had been wet, and then at first it was but just perceptible. Afterwards it gradually opened, I suppose owing to the oxidation of the native iron it contains, perhaps however to other causes. The stone had not been wet till they came into my hands, April 21st. They each of them fell in cultivated fields, one of which had been harvested. The straw in the other was still standing.

The *noise* seems to have been terrific to the Natives, causing those near to crouch from fear. It came like two claps of thunder, as they fell one after the other, and continuing for some time, but gradually growing less loud. As they fell through the whole depth of our atmosphere this would naturally be the case. The noise appears to have been heard at Tuticorin forty miles distant. At this place, sixteen miles North, it excited considerable interest among those abroad at the time. The noise must have been great, occasioned by their great velocity. Taking their specific gravity into the account, say 3·3, their size being about that of large cannon balls, some allowance also being made for their irregular

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Tuticorin. The report of the descent of these bodies was heard distinctly at Tuticorin 40 miles off, and in all the surrounding villages.

The subject appears to me an interesting one for scientific enquiries, and this is my chief reason for requesting you to have the goodness to cause its insertion in the columns of your paper.

I am, Sir,

Your obedient servant,

J. COLEBROOKE,

Zillah Surgeon, Madura.

MADURA, 9*th April* 1857.—*Athenæum.*

shape, from the depth they penetrated the soil, which was of about common hardness, those who have observed the power of projectiles in such cases, will be able to calculate, approximately, what that velocity was.

Of the excitement among the Natives I suppose I need not speak. I visited the place because of the rumours that were flying abroad, making it evident to my mind that some thing peculiar had there transpired. First I saw the holes from which, in the cultivated fields they had been freshly taken, no rain having subsequently fallen, and saw at the bottom the *hardly compressed*, and exact impression left by them as they were taken up, and then as soon as I saw the stones, I knew instantly they were the identical ones which had been taken up from those places. As I was more or less known in that region, and there is no gentleman whatever any where near, the rural people, utterly ignorant of the cause, came in great numbers to state the facts and ask some explanation. Some of them supposed they were gods that had fallen; some that they had been shot from cannon on ships at Tuticorin, and some that a Brahmin had brought them from the sea by his Munterums. Some rejected all these theories, but no one could tell or feel satisfied as to how these things could be. By simply striking my staff through the air I could explain to them the noise; and by tying a stone to a string and swinging it, I could make them understand the centrifugal and centripetal forces, and how that from some disturbance in these forces, stones moving about some centre, like the Moon about the Earth, might fall. The explanations gave them relief. They put confidence in me, and gave me the stones at my request, that I might save them from the trouble of any official investigation, and put them into some Museum or Scientific Institution.

P. S.—I forgot to say that there was nothing peculiar in the state of the atmosphere. It was a clear day. When the stone is sent on to Madras, if any scientific Gentleman makes an analysis of it, for the Museum, please be so good as to ask a copy of it for me.

Report upon Captain Taylor's proposed Jetty thrown over the Surf at Madras.

The undersigned* having met agreeably to Extract Minutes of Consultation, July 24th, 1856, have examined the Model of Captain Taylor's proposed Jetty to be thrown over the surf at Madras, and considered the subject as treated of in his Memorandum. The Jetty would consist of a line of piles, or rather masts, planted in the sandy bottom, but mainly dependent for their support upon shrouds or stays secured to anchors on either side of the line. It

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R. KENNEDY, *Assist. Civil Engineer.*

would be a Pile Jetty, peculiar only from the lateral strength being obtained by means of rigging, instead of the usual deep hold on the ground and support from the connection of parallel lines of piles, which ensures the stability of such works in general. The great span from mast to mast can hardly be said to be a peculiarity of structure, as it is not essential, and as Captain Taylor says "it might be necessary to support the centre of the great divisions by one pile screwed or driven."

After carefully reading Captain Taylor's paper, the Committee feel confident that it was written under a wrong impression as to the difficulties to be contended with in piling across the surf; and in the erroneous belief that several unsuccessful attempts have been made to construct a pier.

Mr. Piron's suggested Pier, the only one that ever approached maturity would have rested on iron piles; and no executive difficulties were anticipated in its construction by those acquainted with such undertakings. That this project was not carried on to completion was not the result of failure in execution, but simply the consequence of the work never having been attempted.

Such a Pier as Captain Taylor proposes, would be an ingenious mode of constructing a temporary Jetty to meet a sudden occasion, where spars of sufficient length, and the other requisite material were procurable. But as a permanent means of crossing the surf would have great disadvantages, liable to injury, not only from the settling of the masts, but from the anchors losing their hold by the sudden shifts of sand that are of frequent occurrence in the bed of the surf. It would in the opinion of the Committee be a constant source of anxiety and expense till the masts had worked down to the maximum depth required, when they would take the place and act but indifferently the part of driven piles, which might have been inserted far more accurately as to position without the aid of means so complicated and costly, as the rigging and anchors suggested by Captain Taylor.

With a strength and capacity quite incommensurate with the trade of Madras, such a work when completed would do hardly

more than establish the fact that a Pile Pier would suit the locality, and in the view of the Committee no such mere experiment is necessary. If no other work of the kind had ever been attempted, the Court Town Pier on hollow iron piles carried through a heavy surf on the coast of Ireland by the most simple means, would have shown the perfect practicability of spanning the breakers of the Madras beach by the aid of Mr. Mitchell's screws. But there are many such Piers in existence now, piles have been planted securely in water 50 feet deep, and cases are recorded of their having been screwed into the sandy bottom of the sea to a depth of five and forty feet. The successful results of such trials prove more than is required, and the Committee feel confident that if the object were only, as Captain Taylor says, to carry water to ships' boats outside the surf, a double, or perhaps a single line of iron piles would effect the purpose more securely and more cheaply than the Jetty proposed.

While thus giving their opinion against Captain Taylor's proposal, the Committee must be allowed to notice the great value of such suggestions; though the plan proposed may not be considered suitable on investigation, any reasonable project may be suggestive of the work required; or at all events give life to the subject; and in this case, if it had not chanced that a proposal from England had brought the matter before Government again, this project of Captain Taylor's would have done so most opportunely, and the Community of Madras is not the less indebted to him for the effort to supply this essential desideratum in the Port.

Report of the Committee appointed to examine Messrs. SAUNDERS *and* MITCHELL'S *project for erecting an Iron Pile Pier at Madras.*

The undersigned Members of a Committee,* appointed to report upon a Pier projected for the port of Madras, having examin-

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* FRED. C. COTTON, *Lieut. Col., Engineers.*
CHRIS. BIDEN, *Master Attendant.*
R. KENNEDY, *Assist. Civil Engineer.*
J. GOOLDEN,
WM. BURTON WRIGHT, *Locomotive Supt. Railway.*

ed Messrs. Saunders and Mitchell's plan and specifications; and perused with care the recorded opinions of several who have on previous occasions been engaged in similar enquiries, are now prepared to speak with confidence upon the subject submitted for their consideration.

The Extract from the Minutes of Consultation referring Messrs. Saunders and Mitchell's proposal for Report, does not specify any particular points as requiring the special attention of the Committee, from which they infer that a general opinion as to the advisability of accepting their proposal is all that is expected from them. But having divided their enquiry under the following heads, they think it better to offer their opinion upon each important point investigated, viz.

1st. The practicability of constructing a Pier on Piles across the Madras Surf.

2nd. The fitness of such a Pier for the Port of Madras, with reference to its effect upon the Coast line, and the effect of the sea upon it.

3rd. The suitableness of the proposed Pier in form and dimensions; and in description and strength of material.

4th. The Estimated cost of the work, whether moderate or otherwise?

5th. The value of the suggested Pier whether such as to warrant the outlay required for its construction?

On the first point, viz., the practicability of constructing the proposed Pier, the Committee have no hesitation in offering a favorable opinion. They have every reason for believing that no soil will be met with through which a Screw pile cannot be driven by the apparatus used by the Contractors; and in the Court Town Pier they have proof sufficient that the operation of screwing can be carried on without the surf interfering with the work, while the remarkable experiment quoted by Mr. Lennon in the year 1803, in which a single pile of wood (offering a far broader surface to the wave in comparison with its strength than the wrought Iron piles suggested in this case,) withstood the action of the surf for 6 monsoons,

satisfies them, that each solid Iron pile standing unsupported except by its hold on the bed of the sea, is capable of resisting a greater force than the blow of the Madras surf. Assured upon these points, and having the support of all who adopted Mr. Piron's proposed Pier, which resembled the work now under review in all essential particulars, and above all with the ample evidence before them of Messrs. Saunders and Mitchell's successes in works of a like nature in other ports of the world, the Committee do not hesitate to declare the work not only perfectly feasible, but simple of construction, and such as may be rapidly completed.

Nor are the Committee less confident and unanimous in their opinion upon the second point; viz., that an Iron pile Pier such as is now proposed, is the most suitable means for spanning the Madras surf. First, because it will cause less interference with the ocean-current than any other description of Jetty equally strong and effective, and consequently will risk in a less degree any injurious change in the Coast line; and secondly, because with great strength it will offer no unnecessary resistance to the wave, and thus have one of the chief causes of injury reduced to the utmost.

With regard to the plan of the proposed Pier which is that of the letter **T**, the head being parallel to the Coast, the Committee observe that this form is rendered necessary by the circumstance of the direction of the ocean-current being parallel to the shore and its velocity so great at times, that boats could not be moored with safety across its course.

In examining the dimensions of the Pier, three points have been considered.

1st, Whether the length will be sufficient to ensure the Pier-head being beyond the break of the surf.

2dly, Whether its height above water is such that the sea will not break over it and,

3rdly, Whether the area of platform is sufficient to accommodate the trade of Madras.

The length of the Main Pier is to be 960 feet and the breadth

of the Pier-head being 40 feet, the outer end of the Pier will be 1,000 feet from high-water mark on the beach.

From the best information that is obtainable it appears probable that the surf never breaks at a greater distance from the shore than from 500 to 600 feet, at times when cargo boats could ply; though it may do so in stormy weather when the waves of the bay are so broken that the outer surf cannot be distinguished.

Mr. Taylor, when Astronomer at Madras in 1844, offered the following opinion upon the distance to which the surf extended:

"From a careful measurement in the months of October, November and December 1838, it appeared that on occasions such as it would be considered dangerous to permit a boat to go off from the beach, the surf extended to a distance of 450 to 500 feet from the shore: but that during a smart gale on the 6th December the surf extended to or beyond a buoy which was 828 feet from the shore, but the confusion was such as to render the distinction between breakers (such as occur at sea) and the surf, very difficult." Captain Biden who has given his attention to the same subject, and has had even better opportunities of judging than Mr. Taylor, also gave an opinion upon this point, at the time Mr. Piron's proposed Pier was under consideration. He expressed himself as follows:

"The surf broke at 350 feet from the coping stone on the 14th October 1844, when the last survey was made, and then the weather was moderate." "About 500 feet from the road-bulwark or barrier, and 400 feet from the inner wash of the surf, is a ledge of sand, and just outside this bank the depth increases from 10 to 15 feet, but within and without this ridge of sand, and excepting that sudden change, the soundings are very regular; this bank doubtless causes the break of the outer surf in rough weather." From these statements and the opinions of others who have either like Mr. Taylor or Captain Biden taken the subject into consideration, or who having passed much of their time in sight of the surf have become acquainted with its peculiarities, the Committee do not hesitate to say that if the head of the Pier is placed as Messrs.

Saunders and Mitchell propose, it will be beyond the break of the surf, at all times when the sea is not too rough for cargo boats to be employed.

The height of the platform above the ordinary high water mark is 15 feet; which is far above the crest of the surf even in stormy weather. That it may be found so on the occurrence of those peculiar cyclones which raise the surface of the sea much above its usual level, the Committee cannot say with perfect confidence; but as this effect upon the ocean on the Coast of Coromandel is by no means the constant result of a hurricane, and as even the more usual character of storm has on an average only visited Madras once in 10 years, they do not consider it necessary to recommend any change in the projector's plan to guard the Pier against a risk so remote.

The sufficiency of the wharfage room on the Pier-head will depend upon the rapidity with which the goods are despatched from it, and this again will be mainly influenced by the facilities afforded for their transit between the Pier and the shore.

The Committee observe that in the "Main Pier" or that part of the work which connects the head with the shore, only 17 feet of the entire breadth which is 40 feet, is covered with platform. The reason for this is not assigned, and they cannot think it a desirable arrangement. They do not consider a breadth of 40 feet between the outer lines of piles necessary for the stability of the work, and would look upon so great a breadth on that account as causing a needless expense. But when they compare the traffic of Madras with the means afforded for cleaning the Pier-head, (bearing in mind at the same time how much circumstances often compel the greater part of a day's work to be crowded into a few hours) they came at once to the conclusion, that the Pier is not too broad, and that the change of plan required is an increase in the breadth of the platform and the number of lines of rail it bears. As now proposed, there would be but two lines of rail which under the best arrangement would not probably be found sufficient in the most active season of the year; and as no arrangement however good, could prevent occasional obstructions occurring, it would be unadvisable to trust to one Railway for landing and one for shipping.

In this particular therefore the Committee urge a change of plan. They consider it advisable that the whole breadth should be covered, that there should be four lines of rail instead of two, both on the Main Pier and the Pier-head; and that the rest of the space should be fitted for the use of foot passengers. If this change is made they believe that the wharfage may be found sufficient for every purpose.

The materials used in the Pier are wrought iron and Baltic timber with cast iron screws on the foot of the piles. Regarding the iron work generally, the Committee are satisfied on all points excepting as to the length of the piles. They consider the arrangement of the material excellent and the scantling adequate. And with reference to the perishable nature of iron when subjected to the action of salt water, and air impregnated with salt, the Committee have only to remark that this material is now so universally employed, and has been found to answer so well in situations equally trying, that they feel confident the corrosion and consequent consumption of iron when so circumstanced is not such as to render it unsuitable to the purpose. The waste of material is evidently retarded by the oxidized coating, which in the first months covers the surface of the iron, and the subsequent decomposition of the metal is so slow that no considerable annual expenditure on repairs is likely to be found necessary; while the arrangement of the iron work in the Pier is such, as to render the operation of removing injured portions practicable and simple.

As to the length of the piles, some further consideration is in the opinion of the Committee necessary. Their lengths as shown in the plan which accompanies the specification appears to have been determined upon a line of soundings not differing materially from those now taken, and if the bottom of the sea near the coast remained stationary, the depth at which the screws are shown in the drawing would be sufficient. But as the combined action of the surf and current, causes at times a very rapid motion of the sand in shore, and considerable changes take place in consequence in the depth of the sea along the Coast line, it is possible that piles of the length suggested might be undermined. The ocean current

strikes upon different points of the shore at different times; and were it not for the stone bulwark and the groynes that guard the beach, far greater changes might occur in the soundings on any line chosen for the Pier, than need be feared now that the shore cannot be encroached upon. What the maximum effect of this current may be, the Committee have no means of determining accurately. It is probably greater during storms than has been measured; as on the surf and current subsiding after the gale ceases, the bed rises rapidly; but as the boatmen who navigate the surf speak with confidence as to there never being deep water near the shore, it is evident to the Committee that the addition required to the length of the piles is not such as to add greatly either to the cost of the work or to the difficulty of constructing it.

If an effort is now made to detect what the maximum depth of the surf is, some information may be obtained before the North East monsoon ends; as that is the season in which the greatest variation in the depth is likely to occur. This information might be sent to England in January; and upon it the length of the piles might with safety be calculated; due allowance being made for a somewhat greater change taking place than had been observed. As the Committee consider this undermining action of the current to be the greatest danger to which the Pier will be exposed, they beg to call particular attention to this portion of their report.

The Committee do not offer any objection to the use "of Baltic Timber" under the impression that by that name, is implied Red Menel Pine; but if that description of wood has been chosen solely with a view to economy, they must express a doubt as to the advisability of the selection since they believe that Teak of such small scantling as is required in the Pier will hardly cost more than Pine prepared with Creosote, while the former would be found so much more durable than any description of Fir as to warrant if necessary a very considerable additional outlay on its use.

With regard to the cost of the Pier, Estimates have been prepared by two members of the Committee, who come nearly to the same result; namely, that its actual cost, without any allowance for Superintendence and risk would be £70,000. From this it will appear that the Contractors have a margin of about 30 per cent.

for Superintendence and profit and the chance of loss, and considering the peculiar nature of the work, this does not appear to the Committee to be unreasonable, though at the same time it is so liberal an allowance that it is hoped the additions proposed by the Committee may be included in the present Estimate, in which case they do not doubt that it will be better economy to accept the Contractor's terms rather than to attempt the erection of the Pier by the Government Engineers; who have no experience in works of the kind.

The Committee find a difficulty in conveying in a figured statement the value that might be assigned to the proposed Pier. But a few words will show the existing impediment to the traffic of the port which it is confidently hoped that this work will remove.

The trade of the port, both in respect of Passengers and Merchandize, is carried on in Masoolah boats, calculated to carry two tons of goods in very fine weather. These boats are drawn up on the beach; nearly but not quite beyond the reach of the surf, where the spray breaks over them to the injury of their contents when they are such as to suffer from the effects of salt water. Laden boats are launched with difficulty from the beach; and both in landing and shipping goods, all must be done by manual labour as cranes cannot in such a position be brought into use.

It is needless to remark that the passage through the surf entails further risk of damage and that the inconvenience sustained by passengers is in a sense greater even than that inflicted upon goods traffic. But these difficulties are at the present day greatly enhanced from various causes which are, first the insufficiency of the boat accommodation for the increasing traffic of the port; second, the difficulty of getting the boatmen to work with regularity and order; and third, the constant pilfering that takes place and which is facilitated by the length and often unavoidable deviousness of the transit between the shore and the shipping. All these obstructions to a regular and orderly traffic would be at once removed on the establishment of a Pier. The injury done at the time of arriving at and departing from the shore would be altogether removed, all extra expense avoided, and a facility of transit

secured to every description of traffic, which is altogether impracticable under the present system.

To speak now of the amount of traffic as it actually exists. The lists of passengers, Emigrants and Troops landing and embarking in a given time do not exhibit the number of those who land and return to Vessels calling at the port; neither do they show the many masters, Officers, and men, who land, and re-embark on board the shipping on the roads; nor the far greater number still of those who go off to Vessels to transact business or to work, and if these could all be enumerated there would still remain uncounted the very many who have occasion to cross the surf, but are deterred by the expense, discomfort or danger attending it. The probable passenger traffic cannot then be exhibited with any approach to accuracy, and in attempting to show the goods traffic that may be expected from the returns of the present trade, so great an amount is missing in the Custom House returns in consequence of the entire trade carried on between the port of Madras and all other ports under the Madras Government being entirely unnoticed that the Committee fear even these Statements may mislead those who examine them. They are however induced to submit them as the best data obtainable, begging that due allowance may also be made for the increase that may be fairly expected when the difficulties of the surf are removed.

Statement A* shows the exports and imports of Madras in the

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* A.

Statement of traffic of the Port of Madras in the years 1854-55, and 1855-56. Value of Goods

		1854-55. Rupees.	1855-56. Rupees.
Imports.	Merchandize . . .	1,91,24,962	2,31,33,876
	Treasure, ...	64,81,955	1,37,16,696
	Total. .	2,56,06,917	3,68,50,572
Exports.	Merchandize, . . .	2,39,48,083	2,91,70,905
	Treasure, ...	82,06,956	44,18,750
	Total. .	3,21,55,039	3,35,89,655
Re-Exports. .	Merchandize, . .	7,17,474	6,64,355
Grand Total. .	Merchandize, .	4,37,90,519	5,29,69,145
	Treasure, . .	1,46,88,911	1,81,35,446
	Total. . .	5,84,79,430	7,11,04,591

last 2 years, and the extraordinary increase in the trade, since the year 1843, when the last proposal for a Pier was laid before the public, will be found by examination of Statement B.*

By a Memorandum lately prepared by the Chamber of Commerce, it appears that the average number of boats daily employed throughout the year is 70, which make 4 trips in the day. These boats in fine weather carry two tons of measured goods or one ton and a half of dead weight: but when the surf is high the load is greatly reduced, as sails cannot be advantageously used in these peculiar boats, they are worked entirely by manual labour, and eleven men are required to make good the passage over the surf. The cost of conveying goods by such means is necessarily excessive. The minimum hire of a boat to the usual anchorage of the square rigged vessels a distance of about one mile is one Rupee and a half. To the outer anchorage about 1½ mile is 3 Rupees. The cost of a boat to the anchorage of the country vessels is fifteen Annas and for passenger boats to the shipping, the charge is 3½ Rupees.

To these heavy charges upon each load of one and a half or two tons, has to be added, the hire of tarpawlings to secure in some degree the cargo from the spray of the sea; and also the pay of a watching peon whose presence in each boat is necessary to prevent the pillage which from the nature of the vessels employed, and the rough sea they navigate, the police cannot prevent by observa-

* B.

Total Tonnage of Vessels arriving at the Port of Madras for the year 1844 and 1855.

	Tonnage.		
	English and other Vessels	Country Vessels.	Total Tonnage.
From 1st Sept. 1843, to 31st Aug. 1844..	1,23,297	76,124	1,99,421
From 1st Jany. to 31st Dec. 1855	2,06,879	1,08,107	3,14,986
Increase ...	83,582	31,983	1,15,565

tion from the land. The proposed Pier will reduce these charges to a comparative trifle, large boats worked by a few hands, aided by sails, will be employed between the Pier and the shipping, and if a guard is necessary at all, one man only will still be required in each boat however many tons she may convey. But the saving on these accounts, great as they will be, will not equal in amount the sum economized by the expedition with which vessels will be cleared of their cargo and reloaded. The loss by demurrage is now even greater than the charge on boat hire and the saving of time that will be effected by the Pier must tell most favorably upon the trade of the port. Another benefit that will be derived from the Pier, and one of great moment is that it will enable ships to obtain fresh water by means of their own boats; as pipes may be carried over the surf for this purpose and thus one of the great objections to Madras as a calling port will be removed.

Although the Pier will not be approachable at all times, suitable boats will in the opinion of the Committee be able to receive and deliver cargo under the shelter of the T head whenever they can be loaded with safety by the ship's side. The skill that is now so conspicuous in the management of boats in the surf, will soon be applied to the new description of vessel employed, and even when the weather is violent, communication will be held with the shipping in cases of emergency; besides greater facility being afforded for sending off anchors to ships in need. While the possibility of launching life boats from the end of the Pier in a severe storm, which could by no other means be taken over the surf at such a time will supply a desideratum that has long been sought for in vain. Making therefore due allowance for the days when the Pier could not be used for general purposes, the Committee still feel certain that its effect will be such as to alter entirely the character of the Madras port. And as the returns show that a charge of five per cent upon the outlay required, would hardly have amounted to 2½ Annas upon the tonnage of vessels that anchored in the Madras roads during the last year, they do not hesitate to say that the benefit to be anticipated from the work is such as to warrant the expenditure on its construction.

The Committee have elsewhere stated it as their opinion, that such a Pier as is now proposed will be the best means of spanning the surf; they would now add that whatever improvement of the port of Madras may hereafter be undertaken, they are confident that it will be then admitted that the construction of a Pile Pier was the first step to be taken.

Before closing their report the Committee would venture to offer a suggestion that a proposal should be made to Messrs. Saunders and Mitchell that in the execution of the work two lines of piles connected by a platform should first be carried over the surf, and that the full breadth should afterwards be completed. The Committee feel confident that such a work would be sufficiently stable, and they observe from the Contractor's pamphlet upon screw piling, that its execution would be perfectly practicable. They admit that this mode of working would entail some inconvenience, and additional cost; but the value of such a Pier for a year or two, in the opinion of the Committee, would be well worth the difference in expense, for if this plan was adopted, an *immediate* benefit would be derived from the work. The Committee need hardly say that some limit in the time of execution should be entered in the specification.

Memorandum on the papers connected with the proposal for a Pier at Madras, by Colonel A. COTTON.

It appears from the Report of the Committee on this question, that they considered themselves called upon rather to give their opinion upon the practicability, cost and advantages of a Pier; and not to go into the greater question of what upon the whole it might be best to do at the present juncture for the improvement of the Port of Madras.

The points the Committee proposed to themselves for examination were,

1st, The practicability of a Pier on piles.

2nd. Its fitness, with reference to its effect on the Coast line, &c.

3d. Its suitableness in form, &c.

4th. Its cost, &c.

5th. Its value, &c.

I propose therefore to consider the general question, viz., what under present circumstances it would be most advisable to do for the improvement of the Port of Madras.

I may observe that this is a question (that of the best mode of correcting the evils of Madras as a Port) which I have had before me for 20 years, and therefore I have had abundance of time to come to a decision on the subject, and of the main point I feel perfectly satisfied, viz., that a ship breakwater, consisting of a straight line of loose stones, similar to those at Plymouth, Portland, &c., and parallel with the beach, is the work that should be undertaken.

I therefore proceed to give my reasons for this conclusion; in respect of

1st. Its practicability.

2nd. Its effects.

3d. Its cost.

4th. The present circumstances.

1*st. Its practicability.*—Of this I suppose there can be no doubt in the minds of any in the least conversant with such matters. To throw a quantity of stones into the sea is certainly one of the simplest operations an Engineer can have to perform. But it is a point we need no guessing about, because we have the fact of many such works having been executed, and being now in progress in the most exposed situations that could be found in the world. After trying many fanciful modes of executing such works, engineers are now satisfied that nothing can be done beyond throwing a certain quantity of large stones down on a given line leaving it to the sea to throw them into such a form, as will bear its violence. In this way the breakwaters at Portland and Holyhead are now being formed. I need not attempt to answer here the various objections that might be started (as is universally the case) by persons entirely unconversant with such matters, because they are endless, but I may allude to one, because it has been so often suggested, viz., that such a work might be swallowed up in

the bed of the sea; it might as well be suggested that it would perhaps float away, but our best answer to this is, that the boat breakwater which was begun in these roads and never finished, remains to this day. As to material, there is plenty of stone obtainable on the Coast at Covelong, on the line of the S. Coast canal generally, and on that of the Railway; as to the means of conveying it, it may be done as that for the boat breakwater was, that is, passed over the surf on Catamarans if not by any better means that may be proposed.

2*nd. Its effect.*—The effects of breakwaters are fully ascertained; they afford a perfect shelter for vessels in all weathers; under them, if there is good holding ground, vessels can ride out the most severe storms. As respects the communication with the shore, they preserve smooth water, and ensure perfectly convenient landing at all times, excepting perhaps during the height of a gale when a boat could not exist any where excepting close under the lea of some shelter.

But it by no means represents the true state of the case to say, merely that a breakwater forms a safe harbour; it should be remembered, that an artificial breakwater affords a harbour far superior to any natural one. There is probably not a natural harbour in the world, that has not some natural dangers connected with it, for reefs and islands do not appear only where they are wanted but too often just where they are not wanted. But in making an artificial harbour, artificial reefs are of course placed only where they will be useful. Thus an artificial reef parallel with the Coast at Madras would not have a range of sandheads with a stormy monsoon blowing direct upon them, and covered with breakers to seaward of it, warning ships off from the harbour behind them, nor would it have a five knots current within it, in which ships must anchor; nor would it have a Back-bay in which vessels might be lost, nor a stretch of 20 miles of water, over which if a hurricane blow, the ships at anchor might be dashed against each other, as they have been in Bombay. The port of Madras would be in every respect superior to those of Calcutta and Bombay. There would be no Pilotage, no time lost in running in or out at any time; and land-

ing Piers might be constructed to any extent at a very small expense, and even carried out to where ships might be along side of them. In fact for all the great desiderata of a port; for convenience of access, for smallness of risk in and going out, for cheapness, and for security no port in the world would be superior to it.

Of course under the shelter of such a work, every thing in the way of wet-docks or other conveniencies of a port might be constructed as in any other harbour and any length of wharf of any kind might be constructed at a moderate expense.

I must however speak also of its "effects" upon the line of Coast. When lately in London, a Merchant Mr. Robertson the member for Hastings asked me about the possible improvement of the port of Madras, and when I suggested a breakwater, he put to me what I consider the most pertinent question in the matter, viz; would not the sand gradually extend out from the shore till it joined the breakwater. My reply is this; we need not theorize when we have facts; North of Madras we have two natural breakwaters, the Pulicat and the Armegon shoals, and these are both to this day unconnected with the coast at either end; this seems to me perfectly conclusive. These reefs differ indeed from the proposed breakwater in that they do not come above the surface of the water; but they are sufficiently near the surface for the main force of the swell of the sea to be expended on them instead of breaking on the shore and this I consider to be just the same, so far as the effect on the beach is concerned, as if they were above water.

As it is of importance that this paper should be as short as possible, I had better not go into detail about the motion of the sand on the beach. I will only say that it is caused by the surf striking the beach a little obliquely, so that the sand that is stirred up is always deposited a little to leaward of where it was taken up, and hence there is always a stream of sand moving along the coast, and if the surf were prevented by a breakwater, there would certainly be an accumulation of sand to windward of the point where the action of the surf ceased; this accumulation I believe

would proceed, but more and more slowly as the deep water was approached till the current passing between the breakwater and it, was increased by the diminution of the channel, sufficiently to sweep away the sand as fast as the surf brought it forward, so that I conclude there would be an accumulation of sand on the beach to the Sd. of the breakwater, but from the example of the two shoals to the North, I feel satisfied that the passage between the end of the breakwater and the shore would never be closed. In the progress of things during the construction of the groynes, along the line of beach of late years, we have clear proof that the quantity of sand, in motion along the coast is not so very great, for since the number of groynes has been increased, extending as they now do for three miles along shore, the filling up between them with sand, has gone on very slowly, and it will probably be some years before the whole length of beach is extended much to seaward, though when there were only two or three groynes, the sand was deposited very rapidly. The only remaining effect that I believe the breakwater would produce on the line of the beach, is that somewhat to the Northward of the Nothern end, the beach would be cut away to some extent in consequence of the action of the surf upon it, while the sand removed by it, was not replaced by any surf under the lea of the breakwater, but this is of no importance.

I am thus perfectly satisfied that a breakwater would not have any injurious effect whatever on the beach.

3*rd. Its cost.*—The section which such a work will naturally take is now well known ; the inner slope is about an angle of 45° and the lower part of the outer one is the same. From a little above high water to a little above low water, the slope where the seas are excessively heavy is about 5 to 1, hence the cost of such a work very much depends upon the rise and fall of the tide. If this is great, both the work must necessarily be so much higher, and also the part on which the slope is so great must extend through a greater height, whereas in the present case, the rise being only 1 yard, the cost will be greatly diminished, as compared with such works in England. Further I feel assured that the force of the

seas in this locality are far below those in that of the Plymouth breakwater for instance, which is exposed to the long continued gales that sweep across the wide stretch of the Atlantic. Our gales never continue many days, and in the hurricanes the wind never continues many hours in one direction. The comparatively small power of the seas is shown by the fact that after a hurricane, when the sea has risen above its ordinary level, very few stones are thrown up on the beach out of the bulwark.

"All experience tends to show that gales of wind and hurricanes have occured at intervals of several years and that there are timely warnings indicative of their approach and also that they are of short duration. For instance in the heavy gale of October 1842, the sea and surf raged with great violence from 8 A. M., on the 23rd to 2 A. M., on the 24th, yet at 6 A. M., within 24 hours from the commencement of the gale, and a few hours after its decline, the surf had so completely subsided, that boats and catamarans were enabled to ply."—Captain Biden.

Supposing that the work is placed in $6\frac{1}{2}$ fathoms at low water, that the long slope extends from one yard below low water to 2 yards above high water, and that the top of the work is 4 yards above high water, the section would contain about 800 square yards, or 1000 tons per yard in length.

Such a work may be made of any length at first and extended as the trade of the port increase to any amount.

During the stormy season the number of vessels in the port will always be moderate, because the coasting trade is stopped, and during the fine season if all the vessels occasionally cannot be covered by it, they would still all have the benefit of the cheap, safe and convenient, communication with the shore that it would afford, so that as soon as a moderate length is executed all the main points will be gained. It must also be remembered that very soon when the coast canal is extended to the Godavery in the North, and the Cauvary in the South, the coasting trade will be greatly diminished, for the canal transit will be greatly cheaper than that by the coast. On these accounts 1000 yards length of breakwater will afford the

main advantages which are sought, and if we estimate now for 2000 yards, we shall probably allow for enough considering the present trade, and it is one of the great advantages of such a work, that it may be carried out just as it is wanted, the length having nothing to do with the stability.

As to the cost per ton we have had some considerable experience at the Godavery and Kistna, were probably $1\frac{1}{2}$ million tons have been quarried, and they have cost about 10 annas a ton on an average including carriage, partly along railways and partly by water, and the greater part of it with very imperfect apparatus. The quarrying here will probably not be more expensive from the appearance of the rock at Covelong, and superior apparatus would be used. With large blasts and powerful cranes, so that there will be little necessity for small charges, we know from the works at Portland and Holyhead, how very cheaply such work can be performed.

With respect to the crossing the surf, we have abundant proof how cheaply a small jetty can be constructed sufficient for such a purpose, in the way the *single* row of screw piles now extending 420 feet into the sea from the beach, has stood the late gales. It is quite clear that two such rows supporting each other would be quite sufficient to carry the stone to the back of the surf, if they extended to 600 feet from the beach at Madras. But I believe the best spot to obtain the stone at would be Covelong and the Seven Pagodas, where the surf is more moderate. At the former place there is a sort of cove formed by a projecting point of rocks, and also a reef detached from the shore, out of which probably a very good shipping place could be formed at little expense. There is there perhaps $\frac{3}{4}$ million tons of stone, which it would be worth while to take and the rest might be got at the Seven Pagodas. The distances from these places to the roads are respectively 20 and 30 land miles; and over this space the stone boats might be towed by steamers. It must be remembered that the number of stormy days in the year in this locality is very moderate, so that such work would not be interrupted in the way it is in England.

Bringing the stone in this way, I think if we allow 50,000£ for

plant, viz. steamers, boats, rails, cranes, &c. for 1,200 tons a day and 1 Rupee a ton besides for quarrying &c., we shall be safe, and this would make 25 lacs for 2,000 yards,* and it might be extended at the rate of 1,000 Rupees a yard.

There are excellent data now for this sort of work in England from which allowing for the difference in the price of labor, very safe estimates may be made. But this seems quite sufficient to show that the cost of such a work would be very small compared with the vast objects in view. The interest at 5 per cent. would be $6\frac{1}{2}$ annas (10 pence) per ton on the present tonnage (315,000 tons) or $\frac{1}{5}$ per cent. on the reported present value of the imports and exports (711 lacs of Rupees). But these do not include the coasting trade, which strange to say, is not entered in any form in the Custom House returns.

The Pier Committee state that about 70 boats make an average of 4 trips in a day throughout the year, carrying each 2 tons or under, which would give about 150,000 tons a year shipped and landed at an expense of from 8 annas (12 pence) to upwards of 12 annas (18 pence) a ton, or perhaps 10 annas (15 pence) on an average, total 100,000 Rupees, besides Passengers. So that no doubt on the *present* traffic the interest of the cost of such a work would be saved in boat hire alone, leaving the diminution of risk and detention of vessels, that of pilfering and damage of goods in the boats, the time, convenience and safety of Passengers, &c. and

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* Rough Estimate of the cost of a Breakwater, 2000 Yards in length, for Madras Roads, in $6\frac{1}{2}$ fathoms water.

	Rupees.
One Steam Tug of 100 tons burthen, and 40 Horse power, Rupees 35,000	
Six do. - - - - - - - - -	2,10,000
One Stone Boat of 100 tons, - - - Rupees 5,000	
30 do. - - - - - - - - -	1,50,000
Waggons, Cranes, Rails, &c. - - - - - -	1,00,000
Jetty, &c., to facilitate loading boats, &c. - - - -	40,000
	5,00,000
Stone.	
2000 × 800 = 16,00,000 at $1\frac{1}{4}$ = 2 Mn. Tons at 1 Rupee including Sundries, - - - - - -	20,00,000
Total Rupees..	25,00,000

those of all the future increase of traffic, as clear additional benefits.

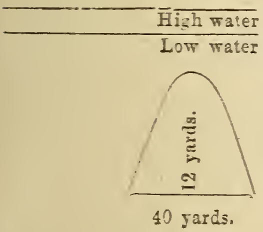
The foreign trade increased 20 per cent. in the last year, and it is quite certain that as the internal improvement of the country in irrigation and cheap transit, and the wealth of the people are quite in their infancy, the trade of the Port of Madras is also yet quite in its infancy. We may safely infer that even if the present partial system of improvement of the country is continued, the trade of the port will be doubled and more likely quadrupled before a breakwater is finished, even if it is begun immediately.

At present the ordinary cost of conveying to the large vessels is 12 annas or 18 pence per ton, which is equal to fully 150 miles of carriage by the coast canal, so that a ton of goods from Tanjore would pay the same for conveyance to Madras by the canal as from the shore to the ship.

4*th. Present circumstances.*—The fact that the Hon'ble Court seriously consider the question of an expenditure of 100,000£ on a Pier at Madras shows plainly the nature of the times at which we have now arrived, and that to leave things any longer in the old state in this port is not to be thought of. In fact whatever it may have been in times past, the port is now totally out of keeping with the whole of the present system of management of the country. To spend 3 millions on a Railway, and as somebody well expressed it, to end it in a massulah boat, is altogether preposterous.

I think we may safely consider that all have now come to a decision on this point, and that something effective must be done to this important port. The question then is confined to this point, what is it to be? It is quite certain that the main points will not be attained by any Pier. It not only will not shelter the shipping, but it will leave even the landing and shipping of goods and passengers in a very imperfect state. There will be a great swell at the end of the Pier, which will be quite exposed to the sea; and most assuredly if ten lacs are spent upon it, there will even then be the same urgent demand for a breakwater as there is now, It is quite certain at least according to my judgment that an expen-

sive Pier of this sort, will be quite unnecessary after a breakwater is constructed. Indeed when Madras is situated on a sheltered bay (though an artificial one) the whole question of landing and shipping will have to be reconsidered, for it is evident that almost any thing may then be done in the way of wharfs, docks, &c., so that in my opinion it will be a most grievous mistake to spend, in fact to throw away 100,000£ upon a Pier, which would be totally unsuited to the new state of things, that would be caused by the execution of a work which may be done any day, which is certainly the only work that can make Madras a safe and effective harbour, and which will not cost so very much more than a Pier such as is contemplated. In fact we may go farther than that and safely say that if the same sum of 10 lacs were spent on 600,000 tons of stone, thrown down on a line of 2,000 yards in length, parallel with the beach in 6½ fathoms, forming a reef of a section of 300 square yards, or about 40 yards broad at the base and 12 yards high, that is reaching to within a yard of low water, it would be far more beneficial than a Pier, for it would certainly ensure almost smooth water for the ships, and entirely destroy the surf.



Such an artificial reef would effectually destroy the oscillation of the sea, which would break on it, instead of on the shore.

Hence to spend under these circumstances 100,000£ upon a Pier, when 250,000£ would *probably* be sufficient to make Madras much superior to any harbour now in India, and equal to any in the world, appears to me the greatest mistake, and if it is thought that such a work would cost more than ¼ million, it would not essentially alter the case, for it is certain that it would be far more economical to spend even half a million in making a harbour than 100,000£ in making a Pier. Five per cent on the latter sum would not be 1 Rupee per ton on the *present* tonnage, and really the present tonnage is no measure of the future tonnage. The mere formation of a harbour would itself have a prodigious effect on the trade, and the Coast

Canal which is now so considerably advanced will alone go far to collect the produce of a great part of the Presidency to Madras. When once goods reach the Canal, the cost of bringing them to Madras even from 2 or 300 miles will be so little, probably not more than a Rupee a ton, that it will have a great effect on the trade, and when by means of improved rivers, branch canals, or even of cheap railways and common roads the whole interior is opened by cheap transit to the coast canal, the increase of trade will certainly be enormous.

But by no means the least important point in this question remains to be considered. The Railway which is now under construction is in a direct line from Calcutta and Madras towards London. Without a harbour at either end, and merely as a line connecting the E. and W. Coast of the Peninsula, I look upon this work, as one of the least important lines on which 3 millions could have been spent; assuredly nothing of any consequence either in goods or passengers will ever be conveyed by it from one coast to the other, and at least 200 miles of it are perhaps about the least productive line of country that a railway could be carried through in India. Further it is proved beyond all question that the passenger traffic is the main source of profit on railways, and that the great mass of passengers only travel a few miles (the average for all England is 13), that is, they go to the next town and back. Strange to say, this railway of 450 miles, is not to pass through one of the few towns (only 7 and all but one very small) which lie near its route, so that it looks as if the ultimate object had been to make a railway, not to carry the people. But if it is treated as part of the line of communication between London, and Madras and Calcutta, it then becomes a work of real importance though it is so defective as a local communication. It would save 4 days in the fine season, and 5 in the S. W. monsoon. In the latter season it would be so many hundred miles dead to windward. But to make it thus available, or at least to make it a thoroughly effective portion of the line from London to Madras and Calcutta, it must have a harbour at each end, and if 3 millions are spent on the road itself, it is surely worth while to spend ½ a million more in order so to complete it.

Can it possibly be said while we are spending so many millions on the railways, that it is out of proportion to spend $\frac{1}{4}$ million on a harbour, at a seat of Government, and a place which is already a great commercial centre, notwithstanding almost every kind of hinderance, such as a want of internal cheap transit, an unsheltered roadstead, a heavy surf, &c. The exports from Coringa have increased seven-fold, since the improvements in irrigation and transit, although they do not extend beyond the little tract of country which forms the delta of the Godavery ; what will they increase to when 50 times that extent of country is opened out by cheap carriage, and how surely the same thing will take place at Madras, if even the present partial system of internal improvement is persevered in.

I avoid going into any detail in this paper, respecting the construction of the work, as I think it would be quite out of place ; I will only say that I feel assured that there will be no difficulty whatever in it, beyond what ordinarily occurs in executing works of magnitude. And it must particularly be remembered that a work of this kind may be carried to any extent and executed at any rate of progress that may be convenient. Five lacs or ten lacs a year may be set apart for it, and in the very first year, a material, nay an essential change, will be made in the port.

I conclude with earnestly requesting that these points may be thoroughly considered, and with recommending that this obvious, simple, and effective work may be at once undertaken. I append a chart* of the coast N. of Madras, showing the Pulicat and Armegon shoals. For thirty years it has been repeatedly proposed to use the shelter afforded by the latter as a Harbour, in connection with Madras. It has of course failed, because a harbour must be where the Commercial community are, and there is 100 times too much capital invested at Madras, in connection with the Port, to allow of the trade being removed to another site. We must either make

* Note.—In this chart the Pulicat shoal is incorrectly laid down as though there was no passage between its southern extremity and the main. Whereas it will be seen that in the plan marked in pencil the least depth is 5 fathoms as shown by the soundings.

a city at Armegon, or a shoal at Madras, and the latter would perhaps not cost a twentieth part of the former, so that there can be no question which alternative to adopt. However all that has been written by many able men to show that an effective harbour exists under the shelter of the Armegon shoal, which is from 4 to 6 yards under water, goes to prove that Madras would be a harbour even before the Breakwater reached the surface of the Sea.

The Directors of the Assam Tea Company report that the outturn for 1855-56 amounted to 638,000lbs. The outturn for 1856-57 is expected to reach 700,000lbs. The company is, however, embarrassed by the difficulty of procuring labour. The Bengalees and Dangars are turbulent and ill-conditioned, and the Assamese alone are to be relied on. Their wages have been raised eight annas a month, but the supply is still deficient. Nothing is said about the financial position of the association.—*Allen's Indian Mail, April* 15, 1857.

NOTICES OF BOOKS.

Oriental.

Lieut. H. G. Raverty of the Bombay Army is bringing out a *Dictionary* of *the Pushto language* to consist of 40,000 words and to extend over 1,000 or 1,200 pages—also a *Pushto Text book* which will contain selected portions, Poetical and Prose, of the most celebrated authors carefully collated from M.S. copies in the author's possession. When it is known that Lieut. Raverty has been engaged over these works for the last nine years, and that he possesses probably a better knowledge of Pushto than any other European, we may feel certain that no labor has been spared in their compilation, and that they will fulfil the expectations of the most ardent linguist. A Pushto Grammar by the same author was published in 1856 and was noticed very favorably in the *Athenæum* of August 30, of that year, which says,

" Except the meagre *Vocabulary of Major Leech*, the *Chrestomathy* of *Prof. Bernhard Dorn*, and the short *Grammar published by Captain Vaughan* at

Calcutta in 1854, no work has been written to facilitate the acquisition of this language, the Grammar, therefore, of Lieut. Raverty, which is sufficiently elaborate, and in which the rules are supported by copious and well chosen extracts from classical Pushtu authors, will be gladly hailed by every linguist."

As there are only a few copies of the Grammar remaining on hand, if he can procure 250 subscribers, Mr. Raverty intends publishing a 2nd edition revised and improved to be ready at the same time with the Dictionary and Text book.

Another *Sanskrit Grammar* is announced from the Oxford Univerty Press by Mr. Monier Williams, Professor of Sanskrit at Haily-bury; its design is to show the relation that exists between Sanskrit and the classical languages of Europe, and the facility with which Sanskrit may be acquired by Greek and Latin Scholars.

The Journal Asiatique, No. 32, for November and December 1856, reviews a book lately published, entitled "*Acar ussanâdîd.*" *Traces of important personages*, or *The History of Delhi and its Monuments, ancient and modern, by Saiyid Ahmed Khan, Delhi* 1854. The Reviewer says :—

"This monograph of Delhi by *Saiyid Ahmed Khan*, Magistrate of Delhi, and author of several other works also written in the ordinary language of the N. W. of India, is by far the most useful of any hitherto published in India in Hindustani (Urdu). The author informs his readers that his ancestors originally came from Arabia, that they subsequently inhabited Herat and came to India during the reign of Acbar. * * * * *

The principal and the only interesting portion of this volume is that which relates to the description of the ancient and modern monuments of Delhi. These as well as the inscriptions found on them are very faithfully illustrated by correct drawings which accompany the volume. * * * * *

The preface contains an abstract of the history of the Kings of Delhi, one chapter is devoted to the history of the Fort of Delhi built by Shah Jehan, and the other smaller fortresses of this town. Another chapter contains a detailed account of the different buildings erected by the Kings and principal people of the same city. The appendix is nothing more than an atlas containing sixty-five drawngs of the buildings described in the work under notice."

The Journal Asiatique for January 1857, No. 33, thus announces the death of Mr. Von. Hammer, whose great work on Arabic Literature was noticed in our last number.* The following account of his last hours is given by his daughter :

* P. 270, Vol. I. N. S.

Extract of a letter from the Baroness de Trenck de Tonder to M. Reinaud giving an account of her father's death. Dated Vienna 13th December 1856.

* * * "In the midst of his sufferings my father continued to busy himself with the studies which he had pursued during his long life. The day before his death when scarcely able to speak, he explained to me with much difficulty that he wished me to send to the Imperial Library for an Arabic work which he heard had just been published. Alas! he never cast eye upon it. He was constantly asking for books to read or calling for his secretary to write to his dictation. On the very last morning of his life, I was obliged in order to keep him quiet, to bring him paper and ink and to place a pen between his fingers with which he traced a few illegible words.

"During the last fortnight, the oppression under which he labored prevented his lying in bed. All that time he passed in an easy chair before his writing table in the middle of his Library. Such a place was little suited for the attentions which his state required. But we dared not change it. We saw too well that he wished to die surrounded by his books like a warrior on the field of battle.

"On the morning of the 20th November he received the holy sacraments. During the 23rd he was more restless and disturbed than usual. He continued however to write with his pencil on his handkerchief and on his linen; at length he began to doze. We listened with thankfulness to his quiet and regular breathing. Twice or thrice he clapped his hands, a mode of calling his servants he had acquired from his travels in the East. On drawing near however we found him still in the same tranquil sleep. About a quarter past six a deep sigh drew our attention to him; another followed; it was the last!

"I must add a few words relative to the state in which my poor father has left the works in which he was engaged The seventh Volume of the History of Arabic Literature is quite finished, and will be shortly despatched to the individuals and to the Scientific Societies which have received the preceding Volumes. The reflection that he had completed this Volume was a source of great comfort to my father and he has left me full instructions for its distribution. He has expressed a hope in his will that the Imperial Academy will complete what is considered indispensable to the work, at least as far as regards the tables. M. Pfitzmaier is engaged in the revision of the second Volume of the Persian chronicle of Wassaf. I feel sure that the respect due to the memory of the Translator and Editor will prevent any delay in completing this publication which, you are aware, is carried on under the auspices of the Imperial Academy.

I shall not astonish you, Sir, who know the indefatigable application and the immense labors of my father when I tell you that his repositories contain numerous writings in his own hand of which, unfortunately, the characters are for the most part, almost illegible. I need not say that I feel it to be a sacred duty to have these MSS. arranged by a skilful person, to whom, I trust, my practice in deciphering my father's writing, will prove of some use."

M. Reinaud adds in a note that M. de Hammer long ago completed a Translation in French of the Arabian tale of *Antar*. Some years since, the elder M. Pou-

joulat being at Vienna, received the MS. from M. de Hammer for publication in Paris. It is understood that this publication will not be much longer delayed.

Natural History.

A paper on the metalliferous deposits of Kumaon and Gurhwal by W. J. Henwood, late Chief Mineral Surveyor in the N. W. Provinces, which was read before the R. Geological Society of Cornwall has appeared in the last No. of the Edinburgh New Philosophical Journal.*

Mr. Henwood met with copper pyrites and purple copper ore in quartzose veins occurring sparingly in the granitic and gneiss formation and somewhat more plentifully at the junction of the talc and clay slates of Poker, Seera, &c.

Iron ores occur in great abundance throughout the clay slate formation and in some parts of the talc slate series. Mr. Henwood particularly notices the fact that *bunches* of ore dip from the mass of the nearest granite formation not only in the case of the iron of the Himalayas but as regards the gold of Brazil.

The talc slate formation he found to exhibit a strong resemblance to the gold districts of Brazil particularly to the Jacotinga formation in which the richest gold deposits occur. Accordingly he found that gold mines were actually worked in Kumaon and Gurhwal, but in the rudest and most inefficient manner. The usual method of preparing the rock for being worked was to soften it by the application of fire.

" †But in their small and ill-ventilated mines this mode is very ineffective, while the smoke and foul air, generated by the combustion, stop the work of every other person in the mine at the time. The imperfection of the tools and mode of working ; the ignorance which prevails of the advantages of ventilation ; of the economy of labour, by extracting the ore through passages large enough to allow the workmen unimpeded action ; as well as the native smelter's inability to treat any but the richest and most fusible ores ; render it, therefore, an object of paramount importance, in the view of the Indian miner, to avoid, by every possible device, the opening of large galleries. But the softer and more fusible ores are far less plentiful than those which are too refractory for the native smelting furnace ; and the two varieties of ore are so intimately mixed in

* No. I. Vol. III. new series—1856.

† Do. do. p. 139.

the beds, that it is impossible to extract the former without breaking still larger quantities of the latter also. In order, therefore, to obtain a supply for their furnaces, as well as to allow the miner the free use of his tools, large excavations are made, and a selection of ores, as far as practicable, is made under ground, and that which is too refractory for use is heaped up within the mine, to such an extent as scarcely to allow sufficient convenience for the exit of the miner, and the removal of the ore. The ordinary mode of extraction is in bags of skin, tied to the person of the labourer, who crawls, when possible, on *all fours*, dragging the bag after him over the rough floor of the opening. But in many places the opening is too strait even for this, permitting passage only in a prostrate position, the sufferer propelling himself by writhing, and by the aid of his elbows on the sides and of his toes on the floor of the hole. In one mine, indeed, the opening is so small, except in the part wrought under the Goorkha rule, that we found children of only from 10 to 14 years old employed in the difficult and dangerous task of re-opening a communication through fallen rubbish in a gallery of which the sides were broken down."

M. Hasskarl, Superintendent of the Botanical Garden at Buitenzorg, and the successful introducer of the Cinchona into Java has been compelled to return to Europe for the recovery of his health. But before his departure he had commenced two works descriptive of the Flora of Java, one entitled,—

RETZIA *sive observationes botanicæ quas de plantis Horti Botanici Bogoriensis annis* 1855-56 *fecit* J. K. Hasskarl: and the other,—

OBSERVATIONES BOTANICÆ *de* FILICIBUS *Horti Bogoriensis et ad montem Gedeh sponte sua crescentibus, &c.*

It is stated however that it is his intention now to embody all his observations in a single work to be entitled *Hortus Bogoriensis Descriptus* with notices or descriptions of about 600 species.—*Kew Misc.* IX. 196.

Miscellaneous Notices.

Among the new works upon Eastern subjects that have made their appearance within the last year or so, *The Kingdom and People of Siam, with a narrative of the mission to that country in* 1855, by Sir J. Bowring, F. R. S., H. M. Plenipotentiary in China, 2 vols. 8vo. 326, stands pre-eminent perhaps for interest and utility in a commercial and political point of view. At the same time it is gratifying to find that India has made some important contributions. *The personal narrative of a Pilgrimage to El Medinah and Mecca,*

by Captain Burton, Bombay Army, has already attained a second edition. Captain Burton has also written a History of Sindh, and has proved himself possessed of energy and observation which, coupled to his intimate acquaintance with the various dialects of Arabic and Persia, rendered him peculiarly fitted to undertake the pilgrimage of which he has given us so interesting a narrative.

A valuable work from the pen of a member of the Madras Medical Service has just been published, under the title of *The Antiquities of Kertch and Researches in the Cimmerian Bosphorus; with remarks on the Ethnological and Physical History of the Crimea;* by Duncan Macpherson, M. D., of the Madras Army, Folio, and Colored engravings, Two guineas. Some of the early proof plates of the antiquities were exhibited at our meeting in March last, and attracted much admiration. The notice of them will be found at page 284, Vol. I.

More recently has been announced *A Journal of two years' Travel in Persia, Ceylon, &c.* by Robert Binning, Esq., Madras Civil Service, 2 vols. 8vo. 28*s*. (Allen and Co).

The *Athenæum* of April 18, 1857, p. 496, concludes a favourable review of Mr. Binning's work in these words,—

" After this general picture, we might draw attention to many valuable details in Mr. Binning's work, but we shall content ourselves with saying that it will be found a book of reference as to measures, dress, household matters and statistics. The author's opinions on Persian literature are especially valuable. A man who has read through the 60,000 couplets of Firdausi, most of the lesser poets and a more than usual quantum of historical and doctrinal works, is entitled to speak *ex cathedrâ* on Persian writings. Classical scholars may, indeed, be disposed to demur to an authority who places the Sháhnámah above the Iliad. There are many points of comparison between Homer and the Persian Epic Poet; but we shall not enter upon the parallel, which would form a good subject for a separate essay, and would require a book to itself. One coincidence, however, may be noticed, as to the martial enthusiasm the verses of both poets inspire. " The Persian soldiery," says Mr. Binning, " when about to engage in combat, are accustomed to sing aloud certain passages of the Sháhnámah, which practice has the effect of inspiriting them to absolute fury; as the verses of Homer did the warriors of Greece, or as the Runic lays of the Skalds were wont to animate the fierce Berserkars of old Norway." Leaving the stout partizan of the Homeric cause to take up Mr. Binning's glove, we close the volumes in which the challenge is recorded, with a hint to the Greek champions that they may perhaps in this encounter find harder work than in the old fields of Marathon and Salamis."

Christianity in China, Tartary and Thibet; by M. l'Abbe Huc, 2 vols. (Longman and Co.) has just made its appearance and gives a History of the propagation of Christianity in those parts. "If it should not" says the *Athenæum*, (April 25, 1857) "be accepted as philosophically impartial, it will at least enjoy the credit of being thoroughly interesting."

Les Anglais et l' Inde; by M. le Mor. Fridolin, which has appeared in the last few numbers of the *Revue des Deux Mondes* is concluded at page 298 of the *Revue* for the 15th March last, vol. VIII.

Mon. Fridolin has divided his subject into five parts and treated them in the following order.

1. Les Fonctionnaires civils de l' Honorable Compagnie des Indes. (Vol. VI. p. 301.)

2. L'Education des Hindous, les prisons et les Moyens de repression contre les Khonds, les Thugs et les Datturias.(Vol. VII. p. 768.)

3. Le Commerce, les Finances et les Travaux publics sous le Government de l'Honorable Compagnie. (Vol. VII. p. 357.)

4. L' Armee Anglo-Hindoue, Mæurs et Scénes Militaires dans l'Inde. (Vol. VII. p. 721.)

5. Les Grandes villes de l'Inde, deux mois sur le Great Trunk-Road. (Vol. VIII. p. 241.

The death of Dr. Robert Ball, Secretary of the Royal Zoological Society of Ireland is thus reported by the *Athenæum* of the 18th of April, p. 505.

"From Dublin we hear of the sudden death of Dr. Robert Ball,—an esteemed Naturalist, whose name was recently brought under the reader's notice in connexion with the arrangements for the next meeting af the British Association. Dr. Ball was born in 1802. He succeeded the late Dr. Whitly Stokes as Director of the Museum in Trinity College. On the establishment of the Queen's University in Ireland, in 1851, he entered on the additional duties of Secretary of the Joint Committee of Lectures in connexion with the Department of Science and Art; and in 1855 he was nominated Assistant-Examiner for Ireland to the Civil Service Committee. While holding these several appointments he was an active member of most if not of all the scientific Societies of Dublin. He is best known as Secretary of the Royal Zoological Society of Ireland and as Treasurer of the Royal Irish Academy,—an officer next in corporate rank to that of President. In 1850

the University of Dublin conferred on him the honorary degree of LL.D. His published papers are scattered through the pages of different periodicals. Three have appeared in the Transactions or Proceedings of the Royal Irish Academy, viz., 'On the Species of Seals (Phocidæ) inhabiting the Irish Seas,'—'On the remains of Oxen found in the Bogs of Ireland,'—and 'On the Cephalopoda of the Irish Seas.' That he was at all times ready to impart his information freely to others, most of the zoological works published in these kingdoms during the last few years afford ample testimony."

Dr. Ball's books and collections are announced for sale in Dublin.

Since the issue of our last number, Mr. Prendergast has finished his task, and we have now *A complete Concordance of the Poetical Works of Milton.* The Concordance extends over 416 closely written quarto pages, and some idea of the patience it must have made trial of may be formed by referring to words like '*such*,' and '*though*,' the former of which we can now assert (on Mr. Prendergast's authority) that John Milton has repeated 256 times and the latter 273 times in his Poetical writings.

The Concordance has been made, it is said, "from the Edition by Sir Egerton Brydges, in 6 vols. 12mo. printed by Macrone, St. James Square, London, 1835; but of course the references in respect of *Books* and *Lines* are applicable to any Edition."

The work came out in 12 parts, 2 Rs. each part, and was printed by Messrs. Pharoah and Co., at the *Athenæum Press*, Madras.

The Rev. R. Caldwell whose *Comparative Grammar of the Dravidian Tongues*, and whose lengthened labours as a Missionary in the South of India were noticed in our last number,* has had the honorary distinction of LL.D. conferred upon him by the Glasgow University.

Lieut.-Gen. John Briggs, F. R. S., of the Madras Army, has just issued a popular view of the present state and future prospects of the Eastern Continental Empire entitled *India and Europe compared.* (Allen and Co.)

Chapters 1 and 2 are devoted to establish the identity of the races as evinced in four peculiarities belonging to both and to no other race of men. The area and population of India is also given.

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* p. 271, Vol. I.

The remainder of the book, some 230 pages, is a statistical Comparison of the Military and Financial resources of the two countries, their Commerce, Public Works and Educational Systems.

PROCEEDINGS.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening, the* 9*th April*, 1857.

The Secretary laid before the meeting the usual monthly Statement of the Society's Funds.

Read a paper communicated, through the Honorable Walter Elliot, Esq., by the Revd. Mr. Percival, *on the Tamil Epic the Chintamani.*

After a few observations on the late Educational scheme introduced into India, Mr. Percival alludes to the general satisfaction caused by the Vernaculars, instead of English, as was at first apprehended, being made the medium of instruction to the masses. He briefly points out the increased attention the Dravidian Tongues are attracting at the present day, both among Oriental Scholars in England, and on the Continent of Europe.

That such is indeed the case, were other evidence wanting besides the several Publications which have lately appeared in connection with India, its Literature and Language, is sufficiently proved by the fact that one or two Works in Tamil beautifully executed have issued from the Press in Europe.

Under such circumstances Mr. Percival ventures to remind us of the benefits that are likely to arise were we to direct our attention to some of the ancient works of Southern India, which for centuries have been acknowledged by the Natives as Authorities, and have earned the admiration of their best scholars. There are five Classical Works he says answering to this description, and which are reckoned of undisputed authority in all matters relating to Tamil Philology.

1. The Chintamani. 2. Chillapadikaram.
3. Valleiyapathi. 4. Kundalakèsi.
and, 5. Manimèkalei.

For the subject of the paper under notice he has chosen the Epic Chintamani composed by Terudevar. In regard to the action of the Poem, and the incidents essential to its development, it is little more than a Narrative of the fabulous acts of prowess and skill of a King called Jivaka.

Independently of this however, Mr. Percival, whose acquaintance with Tamil Literature is most extensive, states that the Poem throughout exhibits such literary talent and is interspersed with remarks involving such keen *retrospection* into the grounds of human action, that it amply sustains the high character he claims for it. In respect of its views it is peculiarly the Text Book of the Jains, and supports, with care, their various doctrinal peculiarities. For the characteristics of the Jains as compared with the Buddhas and Brahmins, vide Bombay Transactions, vol. 3, page 506. Though Mr. Percival has thus pioneered the way, as it were, in this brief notice of one of the five Classical Works in the Tamil Language, we cannot but hope that he will find time to give us some account of the remaining four, more particularly so when we consider that his extensive acquaintance with the Oriental Tongues fits him in a peculiar manner for the highly interesting task.

The Committee acknowledge with thanks the receipt of the following Reports, &c. from the *Chief Secretary.*

1. Mr. Herman Schlagentweit's Observations in Upper Assam, &c. from January to May 1856.

2. Mr. Robert Schlagentweit's Report on the progress of the Magnetic Survey of India from November 1855 to April 1856.

3. Copies of Reports V, VI, VII, VIII & IX, of the Proceedings of the Officers engaged in the Magnetic Survey of India.

The Society possesses Copies of Reports V, VI, VII & IX, received from the Chief Secretary and acknowledged in last month's Proceedings. No. VIII. was printed at Agra instead of Lahore, and some delay occurred in its issue.

4. Annals of Indian Administration, Part 1.

5. India, No. 17—Reports on Mineral Deposits in Kumaon.

6. India, No. 20—Reports on Pegu, Tonghoo, and Salween, also Major Jacob's complaint against the Punjaub Board.

7. Selections from Madras Government Records—Correspondence regarding the Railway.

8. Second Edition of Dr. Baikie's account of the Neilgherries—with 5 Plates in Tin Case.

9. Report on the Elliot Marbles by the Revd. W. Taylor.

Received by order of the Right Honorable the Governor in Council at Bombay, the Bombay Magnetical and Meteorological Observations for 1854 and 1855.

Received from the Smithsonian Institution the Smithsonian contributions to Knowledge, Vols. VII and VIII, and the Eighth Annual Report of the Board of Regents of the Institution for 1853 and 1854.

Received, through the same source, a Prospectus intimating that Professor *Agassiz* intends publishing, in a series of ten quarto Volumes, the principal results of his extended investigations in the Natural History of North America. It is proposed to print the Prospectus in the fly leaf of the next number of the Journal, and the Committee desire to warmly recommend the work to the lovers of science throughout the Presidency.

The Committee also take this opportunity of acknowledging the receipt, from the Smithsonian Institution, of the Constitution and Bye-Laws of the *New Orleans Academy of Sciences*, which came accompanied by Vol. I, No. 1, of the *Proceedings of the Academy.*

In accordance with a wish expressed by the Members of the New Orleans Society, the Committee will have much pleasure in effecting an interchange of Scientific Productions with them.

The Committee also acknowledge with thanks the receipt from the Honorable Walter Elliot, Esq., of Volumes 9 and 10 of De Candolle's Prodromus Regni Vegetalis. As the Society is already in possession of the first 8 Volumes of the work, it was resolved that the succeeding Volumes be purchased, as they are, or may be, completed.

The Meeting separated a little before 8 o'clock.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening the* 14*th May* 1857.

The Honorable Mr. Elliot, read a letter from Dr. Jamieson of Saharunpoor, announcing the dispatch of specimens of Himalayan Teas, for the Madras Exhibition. Unfortunately they have not yet arrived, having been forwarded from Calcutta in a sailing ship, and meantime the Exhibition has closed. The Indian Teas are represented as being in much request at the periodical Auction Sales, and as realizing good prices. The Black Teas fetch from annas $15\frac{1}{2}$ per lb. for Pouchong, to Rupees 1-15-8 for Souchong. The Green Teas from Rs. 1-15-8 for Pekoe to Rs. 3-4-9 for Gunpowder and Hyson. In preparing the Green Tea no colouring matter is allowed. The color and flavor are brought out entirely by manipulation in cast iron pans. The quantity of land under the cultivation is about 1,600 acres annually. Upwards of a million young seedlings and 20,000 lbs. of seeds are distributed gratis to private individuals, to enable them to form Plantations on their own account. The Tea Plant is now cultivated from the Kalee River in Kumaon to the Indus, or over 4° of Latitude and 6° of Longitude. It has also been introduced with success at Darjeeling.

Dr. Jamieson also forwards specimens of Woodcutting, for which Saharunpoor is famed. The woods used by the Engravers are Doodia, Wrightia, Nauclea parviflora, &c.

An interesting letter from Dr. Drew was likewise read, giving an account of his search for the Gutta Percha Tree of Wynaad. He met with it very abundantly in some places, every fourth tree being of this description. It is plentiful in the middle third of the Karkoor pass, more rare near Davilcotta, and disappears higher up; but it is said to be found immediately under the Nelagiri Peak. The tree is large and lofty, so tall indeed, that it is impossible, with the naked eye, to distinguish clearly the form of the leaves, and were it not for the fruit and flowers lying on the ground, to know that the tree was in flower. Dr. Drew doubts whether the tree is isonandrous, and from a careful drawing and description transmitted, it is clear that it does not fall under that genus as charac-

terized by Wight and Griffiths. The Pachounti, which was sent to the late Exhibition from Travancore appears to differ both from the Wynaad species and from the true Isonandra Gutta. The whole group call for careful revision.

The Secretary read a letter from Lieut. H. G. Raverty, 3rd Bombay N. I., Assistant Commissioner Mooltan, enclosing Prospectus of a Dictionary and Text Book of the Pushto language, which he has been engaged upon for the last nine years. Lieut. Raverty has already published a Pushto Grammar, which was favorably noticed in the *London Athenæum* of August 30th, 1856. Should 250 copies of the latter be subscribed for, he intends publishing a second edition, revised and improved, at the same time with the Dictionary and Text Book.

Resolved, that the Society take one Number of each Work, and that the Prospectus be published in the Journal.

Read a letter communicated through the Honorable Mr. Elliot, on the subject of Colonel Stacey's magnificent collection of Coins.

Captain Wroughton, on behalf of the daughters of Colonel Stacey, has offered the Coins for sale at Rupees 5,000, and the Council of the Asiatic Society of Calcutta, impressed with the importance of securing so valuable a collection, have resolved to call on all interested in Indian Archeology to aid the Society in their efforts to preserve the collection in its integrity, and to deposit it in a place accessible to all Numismatists.

The Committee acknowledge with thanks the receipt of the following contributions :

From the Chief Secretary.

1. Report of the Committee appointed to examine Messrs. Saunder's and Mitchell's project for erecting an Iron Pile Pier at Madras.

2. Report of the Committee upon Captain Taylor's proposed Pier.

3. Memo. of a project of a Ship Breakwater for Madras, by Colonel A. Cotton, Madras Engineers.

4. An account of the fall of two Meteoric Stones in the District

of Madura on the 28th of February last, by the Rev. H. S. Taylor, an American Missionary.

From Colonel Browne.

5. Observations on Free Labour Cotton in the West Indies, by James Banks, late of Honduras.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening,* 11*th June,* 1857.

The chair was taken at ½ past 6 by the Honorable Walter Elliot, Esq.

The Secretary laid the usual statement of accounts before the Meeting, and brought to the notice of the Committee that the Rules for the Society's Management being nearly out of print, a fresh batch of them would have to be printed, and might be taken in hand at the same time with the Catalogue now under revision, and almost ready for the Press.

Resolved that the statement is satisfactory, and that fresh copies of the rules be printed as suggested.

Read a letter from Colonel Balfour, C. B., which was ordered to be recorded.

The Committee beg to acknowledge the receipt of the following papers from the *Chief Secretary.*

1. Observations on Provincial Exhibitions and the improvement of the Resources of the several Districts of the Madras Presidency, by J. Forbes Royle, M. D.

Dr. Royle expresses great satisfaction at the successful results which have attended the attempts to develop the natural resources of this Presidency. He points out the particular objects which should be kept in view with regard principally to procuring markets, to the introduction of new Articles of Produce, of superior implements of husbandry, the improvement of the breeds of Cattle, &c.

This valuable paper was communicated to the Sub-Committee of Papers and will appear in the forthcoming Number of the Journal.

2. No. X. of the Report of the Officers engaged in the Magnetic Survey of India.

The Committee also acknowledge with thanks the receipt of a Catalogue Raisonne of the Books in the Medical College, presented by the College.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

DAILY MEANS.

March 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·914	76·3	70·1	86·9	68·2	E S E	....	Clear
2	·926	78·5	72·4	89·0	72·6	E S E	....	do
3	·911	79·2	73·6	88·3	72·7	E S E	....	do
4	·927	78·6	73·7	88·8	72·4	S E	....	do
5	·941	78·3	72·8	87·7	72·0	S E by E	....	do
6	·908	78·2	71·7	89·0	70·7	S E	....	do
7				88·9	72·9	S E by E	....	
8	·883	81·3	75·4	90·1	78·6	S E by E	....	Hazy
9	·831	81·5	76·0	90·2	77·2	S S E	....	do
10	·868	81·7	76·3	90·9	77·0	S S E	....	do
11	·899	81·9	76·8	89·7	77·3	S E by E	....	do
12	·964	81·5	75·4	90·0	76·4	E S E	...	do
13	·986	80·5	74·5	88·6	75·1	E by S	....	Clear
14				88·9	73·2	E	....	
15	·906	78.7	72·2	87·5	72·6	E	....	do
16	·934	77·9	71·8	87·9	72·1	E	....	Hazy
17	·922	77·6	71·7	86·9	72·0	N E	....	do
18	·906	78·6	72·1	90·2	71·4	S E	....	Clear
19	.894	78·9	72·4	92·7	71·1	S E	....	do
20	·856	80·1	72·8	92·2	72·4	S E	....	do
21				90·9	74·3	S E	....	
22	·854	81·0	73·6	92·3	74·3	?	....	do
23	·849	79·3	72·3	89·7	72·6	S S E	....	do
24	·854	80·7	74·8	90·3	75·9	S	..	do
25	·887	81·5	75·7	90.8	76·0	S	0·099	do
26	·915	83·2	77·9	92·9	78·3	S	....	Hazy
27	·852	83·1	77·9	92·7	77·2	S S W	....	Clear
28	—	—	—	96·9	76·8	W S W	....	
29	·800	81·4	75·9	92·9	73·4	S W	....	do
30	·838	82·7	77·1	92·2	77·2	S W	....	do
31	·875	82·0	75·5	92·6	75·2	S W	....	do
Means	29·896	80·2	74·2	90·2	74·2		0·099 Sum	

April 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·849	80·7	74·9	91·3	73·5	S W	....	Clear
2	·860	81·8	76·4	92·2	75·6	S W	....	do
3	·879	82·0	76·2	92·0	76·4	S S W	....	do
4				93·1	75·6	?	....	
5	·887	82·9	76·7	92·2	77·3	S S W	....	Hazy
6	·897	83·5	76·4	94·9	78·5	S S W	....	do
7	·887	82·3	76·2	92·0	78·7	S S W	....	do
8	·881	83·2	76·9	96·7	76·7	S W by S	....	do
9	·854	84·6	78·6	94·0	79·1	S W	...	do
10	·851	84·4	78·1	93·2	78·8	S S W	....	do
11				94·0	78·1	S S W	....	
12	·837	84·1	77·0	93·7	77·5	S S W	....	Clear
13	·835	85·0	77·7	96·9	78·5	W S W	....	do
14	·833	86·5	78·5	98·4	81·5	W S W	....	do
15	·734	86·9	79·9	100·7	81·8	W S W	....	do
16	·740	87·4	80·6	100·4	83·2	W S W	....	do
17	·774	86·9	80·9	97·0	83·4	W S W	....	do
18				94·6	81·9	W S W	....	
19	·792	85·9	80·1	95·1	81·0	S W	...	do
20	·792	85·5	79·0	94·8	81·0	S W	....	Hazy
21	·799	85·1	78·6	94·2	80·1	S W by S	....	Clear
22	·814	84·4	78·4	92·6	79·5	S W	....	Hazy
23	·807	84·7	79·0	94.3	79·7	S S W	0·123	do
24	·822	84·8	78·3	93·9	79·3	S	....	do
25				94·8	79·8	S	....	
26	·834	85·4	78·6	95·1	79·8	S	....	do
27	·829	85·3	78·5	94·7	79·6	S by W	....	do
28	·814	86·6	78·9	96·1	82·9	S by W	...	do
29	·794	86·5	79·2	97·7	82·0	S	....	Ovcst.
30	·793	85·6	78·7	94·8	80·6	S S W	....	Hazy
31								
Means	29·829	84·7	78·2	94·8	73·7		0.123 Sum	

May 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·801	86·3	78·5	96·5	82·2	S S W	....	Hazy
2				97·6	81·8	?	....	
3	·739	85·8	79·3	96·6	79·2	S W	....	Cldy.
4	·744	86·2	79·2	97·9	79·9	S S W	....	Hazy
5	·751	86·5	79·9	97·0	83·2	S W	....	Cldy.
6	·766	86·3	79·6	97·9	80·7	W S W	....	Hazy
7	·727	87·6	79·0	100·4	81·8	W S W	....	Cldy.
8	·658	89·5	79·6	105·3	84·2	W	....	do
9				105·2	80·7	N W	....	
10	·729	88·5	78·7	104·1	83·7	W	....	do
11	·772	89·0	78·8	103·5	83·1	W	....	do
12	·769	88·6	78·0	98·6	83·6	?	...	Hazy
13	·771	89·0	78·2	102·3	83·8	W S W	...	Clear
14	·748	89·4	78·2	104·9	83·2	W S W	....	Hazy
15	·743	87·9	77·4	98·4	81·9	?	....	do
16				101·2	84·1	W	...	
17	·729	90·5	78·8	106·0	84·8	S S W	....	do
18	·727	91·2	78·5	106·6	85·1	W	....	Clear
19	·734	92·8	76·9	106·3	86·8	N	....	Cldy.
20	·734	91·9	77·2	103·9	86·9	W	....	Ovcst.
21	·723	85·5	75·5	92·6	81·9	W N W	....	do
22	·719	84·7	75·5	100.6	80·2	N N W	0.032	Cldy.
23				104·0	83·5	W N W	....	
24	·722	83·0	77·1	102·3	83·8	N W	....	do
25	·724	89·4	77.2	104·9	84·9	W N W	....	do
26	·690	90·3	75·7	102·9	85·2	W	....	do
27	·653	92·4	75·5	105·0	84·7	W	....	do
28	·664	92·1	75.3	103·9	85·0	W	....	Hazy
29	·689	89·8	75·5	97·1	84·7	W N W	....	Cldy.
30				98·7	82·1	?	...	
31	·712	87.3	77·7	101·2	82·4	W	·026	do
Mean.	29·728	88·7	77·7	101·4	83·2		0·058 Sum	

? This mark signifies that no Means can be taken owing to the variable state of the Wind.

5h 41m	6h 41m	7h 41m	8h 41m	9h 41m	10h 41m	11h 41m	12h 41m	13h 41m	14h 41m	15h 41m	16h 41m	17h 41m	18h 41m	19h 41m	20h 41m	21h 41m	22h 41m	23h 41m	0h 41m	1h 41m	2h 41m	3h 41m	Means.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
In	In.	In.	In,	In.	In.	In.	In.	* In.	In.	* In.	In.	In.	In.	In.	In	In.	In.	In.	In.	In.	In.	In.	In.
28·946	29·867	29·889	29·909	29·923	29·922	29·912	29·897	29·885	29·877	29·873	29·881	29·897	29·917	29 940	29 958	29·963	29·952	29·921	29 897	29·868	29·846	29·834	29·896
·776	·797	·821	·842	·860	·860	·850	·832	·815	·804	·802	·811	·829	·849	·873	·892	·892	·879	·861	·830	·802	·779	·767	·829
·676	·697	·722	·745	·763	·765	·757	·741	·723	·710	·707	·717	·735	·757	·775	·782	·781	·765	719	·722	·696	·672	·659	·728
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
32 5	80·7	79·9	79·3	78·6	77·9	77·0	76·0	75·2	74 5	74·0	73·5	73·3	73·6	77·8	81·5	84·2	85·9	86·7	87·2	87·1	86·8	86·0	80·2
36·0	84·1	83 3	82·9	82·5	82·1	81·7	81·2	80·5	79·8	79·3	78·7	78 3	80·6	84·2	86·9	89·3	90·2	91·2	91·2	90·9	90·4	89·3	84·7
39·4	87·1	86·6	86·2	85·6	85·4	85·0	84·6	84·1	83·6	83·2	82·7	82 6	84·9	87·7	90·7	92·9	95·0	95·3	96·6	96·5	95·9	94·4	88·7
75·2	74·7	74·5	74·4	74·2	74·0	73·6	73·0	72·5	72·1	71·8	71·4	71·3	71·7	74·2	75·2	75·6	76·0	75·9	75·9	75·7	75·6	75·8	74·2
78·8	78·2	78·1	77 8	77·8	77·7	77·5	77·3	77·0	76 7	76.4	76·1	75·8	77·1	78·4	78·9	79 0	79·3	79·8	80·0	80·0	79·7	79·4	78·2
79·2	78·9	78·7	78·3	77·7	77·4	77·1	76·5	76·2	76·0	75·7	75·4	75·3	76·4	76·9	77·6	78·0	78·5	78·7	79·2	79·6	79·5	79·3	77·7

* The Numbers in these Columns are not observed but interpolated for the sake of obtaining the daily means.

W. S. JACOB,
Hon'ble Company's Astronomer.

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